MARINE REVIEW

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THREE LARGE CONTRACTS.

THE ENERGETIC MANAGEMENT OF THE ROACH SHIP YARD, CHESTER, PA., LANDS THAT NUMBER OF ORDERS INSIDE A WEEK.

No ship yard in America has shown a more remarkable growth during the past two years, or displayed greater energy in the whole administration of affairs involved in the industry, from the securing of contracts to the completion of vessels, than the Roach ship yard of Chester, Pa. Now the management of the Roach yard has attracted the attention of the entire American ship building world by capturing contracts for three large ocean steamers within a space of a few days. The first commission, which is for two steamers, came from the American-Hawaiian Steamship Co., the corporation recently organized for the operation of an Oriental line by Flint & Co. of New York, Williams, Diamond & Co. of San Francisco, Dearborn & Co. of New York and other interests, including a representation at Honolulu, Hawaii. These vessels will be of 10,000 tons register, and with the exception of the steamers St. Paul and St. Louis, will be the largest merchant vessels constructed on the Delaware. They will be 430 feet in length, 50 feet beam, 33½ feet depth of hold and 26 feet draught, loaded, their dead weight carrying capacity being 8,500 tons. The vessels were designed by Flannery & Tritton of London and will be constructed under Lloyd's rules for the highest rating. They will be fitted with triple expansion engines of 3,000 horse power, to which steam will be supplied by four Scotch boilers at a working pressure of 180 pounds. It is expected these engines will be able to drive the vessels at a speed of 12 knots. Each of these vessels will cost about $400,000. Orders have been placed with the Union Iron Works, San Francisco, for two similar vessels. All are designed for service between New York, San Francisco and Hawaii. The contract calls for the delivery of one of these vessels within a year and the other three months later.

The second commission to the Roach officials was for the construction, for the New York, Philadelphia & Norfolk Railroad Co., of a new steamer to replace the ill-fated steamer Cape Charles on the Cape Charles & Norfolk route. The new vessel will, however, be much larger and finer than the Cape Charles. She will be 253 feet in length and 40 feet beam, and will be fitted with two quadruple expansion engines of 3,500 combined horse power, to which steam will be supplied by Almy water tube boilers. This steamer, designed by Gardner & Cox, naval architects of 1 Broadway, New York, is expected to carry 300 tons of freight on a draught of 9 feet 6 inches, and the contract stipulates that the vessel shall attain a speed on trial of 20 miles. In the closing of this contract, which involves an expenditure of about $200,000, the ship building company was represented by Vice-President W. C. Sproul.

Other work at the Roach yard is being pushed with all possible speed Over 1,000 men are now on the pay roll, which aggregates $11,000 weekly. The Old Dominion steamer Hamilton will be ready to leave the yard April 20, and her sister ship, the Jefferson, will be launched about the same time. Three of the steam yachts on the stocks are pretty well plated and rapid progress is being made on the fourth. Frames are being bent for the steamer for the Boston and Portland route.

ELEVATORS FILLED TO THE ROOFS.

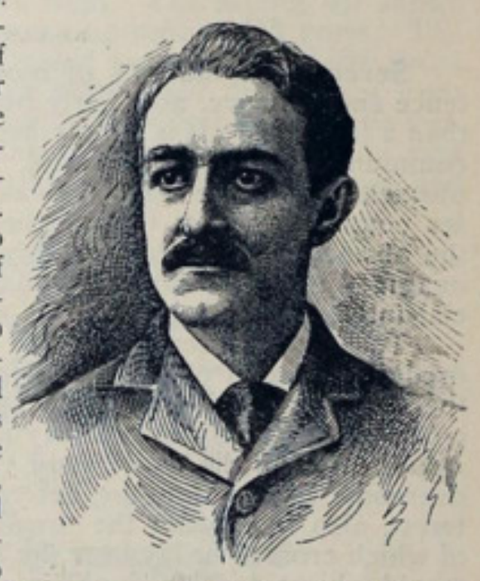
Duluth Minn., April 5.—The last elevator having storage capacity of any kind left in this locality has been filled. In their latest advices to customers LaSalle & Co., vessel agents, say: "The quantity of grain in store in the Duluth-Superior elevators is 20,092,175 bushels, of which 10,486,659 bushels is wheat, 5,559,724 corn, 2,082,805 oats, 300,895 rye, 482,726 barley, and 1,179,366 flax. One year ago today the elevators contained 12,581,657 bushels of grain. Receipts are practically suspended. Wheat now arriving is absorbed by the flouring mills. The elevators are filled to the roofs, and the railroads refuse to accept any more grain consigned to this port. The freight rate has been advanced to 2¾ cents and the remarkable feature of the situation is that the wheat shippers are altogether out of the market. The inquiry has been confined almost exclusively to corn shippers. The wheat market must certainly be established on a shipping basis shortly, which should result in a 3-cent rate. The Lake Ontario rate has been fixed at 4½ cents, vessel paying canal tolls. Some business was done last week on this basis. We look for an active lower-lake market, and it is likely there will be a liberal request for Georgian bay tonnage. It is certain that the month of March rather added to the ice field. There is now, however, a little suggestion of spring at the head of the lakes."

HOLLAND BOAT IN ENGLAND.

The inventor of the Holland submarine boat is now in England, presumably for the purpose of interesting the British admiralty in his patents for submarine navigation. Expressions of opinion in the leading British engineering journals would indicate that Mr. Holland will not succeed in this undertaking. The conservatism characteristic of the admiralty is only one of several reasons advanced for this opinion. In addition there is the contention that the British have no real need for a submarine vessel, inasmuch as their coast is already as well protected as the present state of naval and military science requires; the claim also that the Brennan traveling torpedo, whose secret has been kept with extraordinary jealousy and success, is more effective than any submarine boat; and finally the confidence that if the British government ever desires to employ submarine craft it need not go outside of its own domains for designs. The theory is advanced that there can be no fundamental patents in a submerged traveling vessel and that in any case the government would not be bound by them.

A NEW COMER IN THE LAKE FIELD.

Vessel men of the great lakes will be interested in the personality of James S. Keefe, general traffic manager of the American Steel & Wire Co., on account of his connection with the recent purchase of five vessels of the Wolvin or Zenith Transit Co. fleet. This purchase indicates a disposition on the part of the management of the wire combination to not only enter largely into the mining of iron ore in the Lake Superior region, but to also undertake on an extensive scale the transportation of the ore from mine to furnace. Mr. Keefe will have a great deal to do with American Steel & Wire affairs of this kind, although the direct management of the ships may be given over to other hands. It is said that the company has already practically completed arrangements for two steel tow barges of the largest type, to be built at the works of the Chicago Ship Building Co., but not to be completed, of course, until the spring of 1900, as their is no possibility of earlier delivery. It is also probable that the Cleveland steamers known as the Cleveland Rolling Mill Co. boats, which were not included in the sale of the Cleveland mills, will eventually be sold to the wire company.



Mr. Keefe was born in Boston, January 24, 1864. His business career began with his entry into the service of the Chicago & Northwestern Railway Co. at Milwaukee in 1879. He was at one time or another in the service of several different railroad organizations and finally in 1889 was made freight agent for the railroad properties of the Illinois Steel Co. Three years later he was given entire charge of their track interests and continued to act in that capacity until his assumption of his present position with the American Steel & Wire Co.

THE INDIVIDUAL VESSEL OWNER.

The vessel owner of the lakes who occupies the single position of a carrier is, of course, very much interested in the negotiations of the big steel combinations for the control of iron mining properties. He knows that the operation of mines by the consuming interests in iron and steel means also the operation of ships. It is estimated that if negotiations for mines now being carried on by the American Steel & Wire Co., the National Steel Co., and the Republic Iron & Steel Co., are successful, more than 75 per cent. of the Lake Superior ore output next year will be for what is known as producing-consuming interests. How soon will such of these interests as are not already provided with ships take up also the transportation part of the business? They are certainly getting there as fast as possible. Their positions would undoubtedly be made secure on this score at once if the ships were to be had, but the number of modern steel vessels that are available is not great and it would probably be necessary to offer high prices in order to induce the owners of them to sell.

Thus the general control of ore transportation by the steel companies, although seemingly certain to come eventually, is still a long way off, and for the coming season at least the vessel owner's prospects are bright, especially in view of the great delay attending the opening. There is absolutely nothing doing in either additional ore contracts or new coal contracts, for the reason that the vessel owners are so confident of profitable freights that they will not consider any of the rates which shippers feel warranted in offering.

In Cleveland on Tuesday next a meeting will be held of executive officers of the Lake Carriers' Association and the committees having to do with the grain bill of lading problem. The position of the grain interests that have been considering this question will undoubtedly be submitted and final action by the vessel owners is expected. The formation of an elevator pool at Buffalo, which is now assured, will probably help to settle the differences that exist between the grain and ship interests, but there is no telling as yet how the matter will end.

The advance from 14 to 16 cents a ton for unloading ore at Lake Erie ports will prove quite a disadvantage to vessels that are tied up to 60-cent ore contracts, but the dock managers claim that their business is not a profitable link in the system of ore transportation and the increased labor cost must be met in this way. There are some vessel owners who think that the system of rebates to furnaces on ore and other abuses of the dock business are matters that do not concern the ship. They insist that the vessel should have nothing whatever to do with unloading charges. This is another question that could be settled by the vessel interests if taken up and handled in a determined manner.

A London dispatch of recent date is to the effect that the result of the coroner's inquest into the circumstances of the death of the stoker on the British first-class cruiser Terrible, who was killed by a boiler explosion on board the cruiser, while on her way from Malta to Devonport on March 13, resulted in a verdict exonerating the officers, but the jury recommends that the admiralty discontinue using welded tubes. Seamless cold drawn tubes are being used in the latest naval vessels of the United States.

The bureau of construction, navy department, has made considerable progress on plans and specifications for the new battleships authorized by the recent act of congress. Admiral Hichborn is in favor, however, of proceeding slowly, as there is no need of having the plans ready before congress meets again.

MANCHESTER SHIP-CANAL*

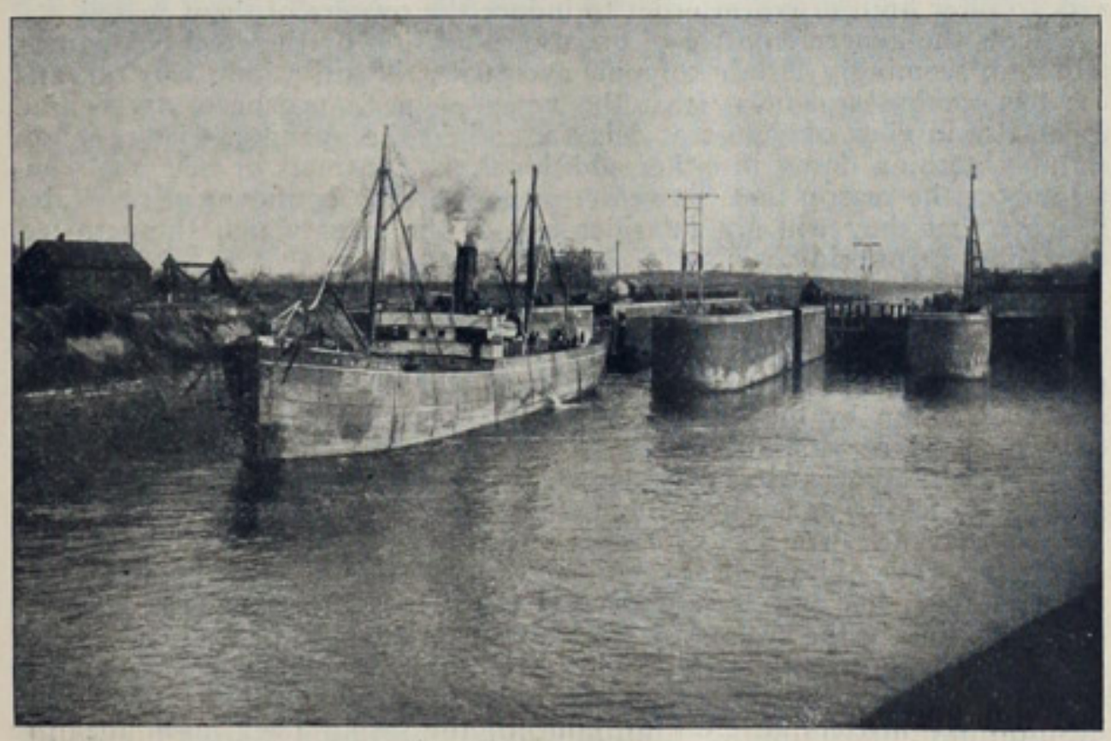
SOMETHING OF AN ENGINEERING PROJECT THAT REPRESENTS AN EXPENDITURE OF $75,000,000 AND FIFTEEN YEARS OF AGITATION AND LABOR — ENORMOUS FACILITIES UTILIZED IN ITS CONSTRUCTION — DIMENSIONS, METHOD OF OPERATION AND THE MAGNITUDE OF THE COMMERCE HANDLED.

BY ELMER L. CORTHELL.

Seventy-five millions of money and fifteen years of effort, persistence and patience, now fairly hopeful of reward, require a volume rather than a few lines. It is simply heroic—the fight for a seaport made by this community. Not only natural, but unnatural and therefore unexpected obstacles lay in the way. It was in itself physically a great task to bring sea commerce direct to Manchester; it was an added task to overcome the obstacles presented by every sort of vested interest, that believed or imagined itself likely to be damaged; rail, water, municipal and commercial interests.

To bring the sea commerce of the largest class to an inland city, by dredging a canal up a small river and straight through the land; and at the city to make a deep water space of over one hundred acres, wharves covering one hundred and fifty acres, with five miles of frontage; all this would astonish the world; and yet Manchester did it. And then to have overcome in addition the determined opposition of a great railway interest, also that of all the towns along the route, the roads and streets of which crossed or lay near the line, and the interest of other cities which would object to this flanking of their commercial business by such a waterway, and that of the people and public corporations who would see and seize the opportunity to levy for consequential damages; all these added obstacles would have daunted even a Yankee community. But nothing daunted, discouraged or delayed Manchester, when once, after careful consideration of the subject, she had decided to make a seaport there. Now that the great work is completed, ocean vessels traversing the canal, the railroads connecting their rails with it, the great systems of barge canals turning their traffic into it, revenue coming in greater than the cost of operation, and financial returns in sight at last, it is time for the whole interesting history to be written by some competent hand. Nothing since Suez and De Lesseps "Le Grand Francaise," can equal the real romance of the story. Suez and Manchester each doubled up its original estimate of cost through opposition and unlooked for conditions which neither the engineer nor the management could anticipate. Suez grew in cost from fifty millions to one hundred; Manchester from thirty-five to seventy-five.

Before proceeding to describe the work, the reasons for constructing it should be understood. Manchester is, by rail, 37 miles from Liverpool. It is the great manufacturing center of England for cotton fabrics, while Liverpool is the entrepot for the raw material from the United States, Egypt and other countries, and the export city for Manchester's manufactured goods. There are other industrial and commercial interests of great importance at Manchester and in its vicinity. The population clustering in many local centers about this city number over 7,000,000, most of whom may be said to receive their raw materials largely through Liverpool, and even their food products as well, and to

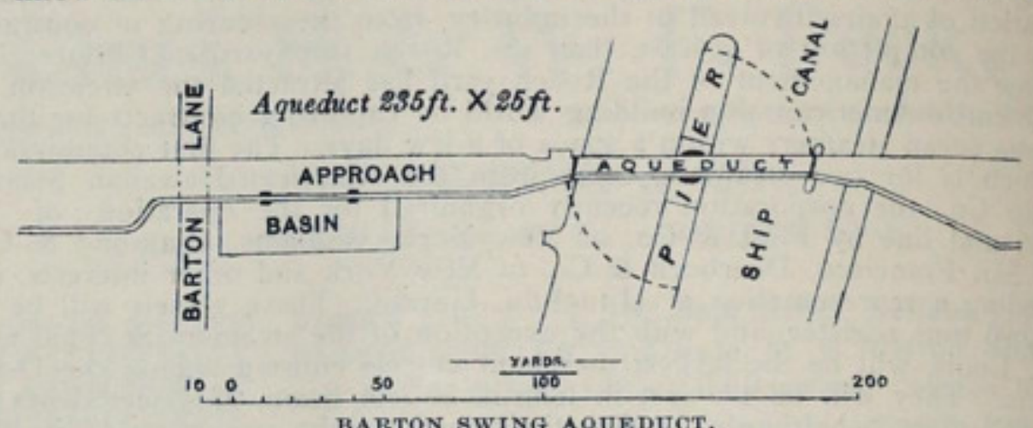


VIEW OF LATCHFORD LOCKS.

ship their manufactured goods out to the world through that port. The charges for handling these goods, including the railway rates for haulage between the ship and these seven million people had become so onerous that it became necessary to reduce the cost of transportation, and so to reduce the cost of manufacture in order that Manchester might hold her foreign and domestic markets.

To go now into some industrial and commercial details:—The Manchester district consumes nearly 600,000 tons of cotton annually, over 2,500,000 bales. The reduction in cost of handling and transporting this product, alone, which the canal has brought about, is nearly $2,500,000. The whole amount of traffic calculated to be tributary to the canal is about 9,000,000 tons, on all of which the rates of the canal were, by the parliamentary charter, not to be greater than one-half of those then in force on the railways. The vast importance commercially and industrially, and, we may say, vitally, to Manchester and its tributary country can scarcely be over-estimated.

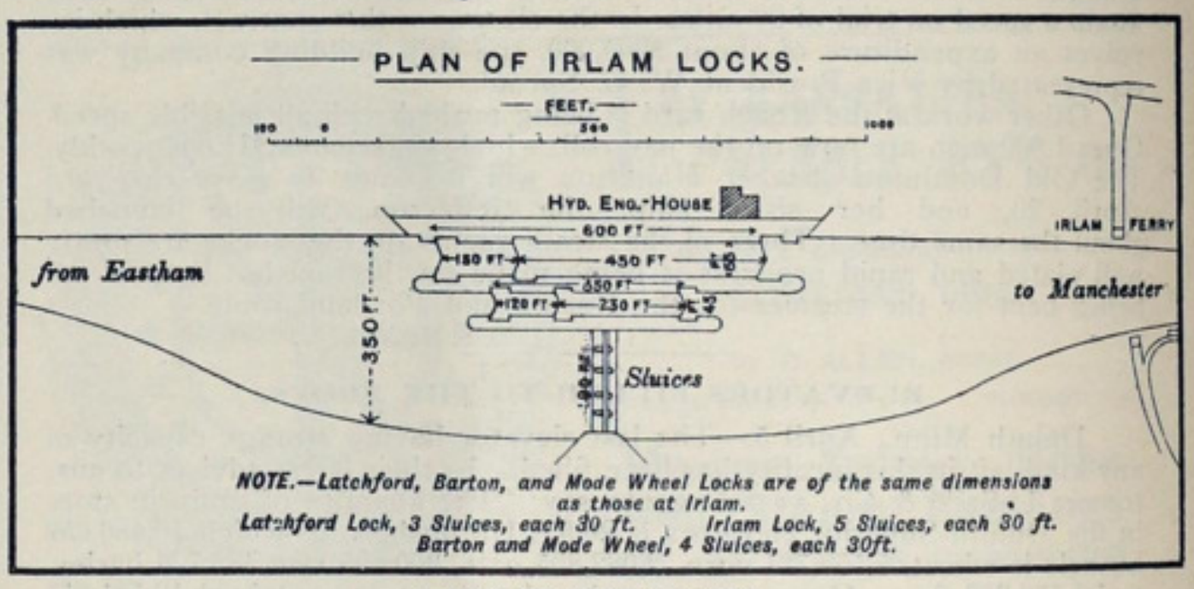
The project for building a waterway that would allow the cotton to be shipped from New Orleans and other United States ports direct to the docks in Manchester does not seem visionary. The timber loaded at Pensacola or Demarara or Norway; the cattle from Argentine or New York; all the great and varied projects of the world seeking the Manchester market, could then reach there directly; and cargoes of goods of all descriptions could be sent back to these and many other ports of the world direct from Manchester to their destination, saving rail rates, cost of rehandling at Liverpool and the Liverpool dock charges. And it may be remarked right here that one salutary effect of the canal already has been the lowering of terminal charges at Liverpool in order to hold her own business. Every great or small work that reduces the cost of living anywhere in the world should have support and sympathy, and therefore, to know how the work in question was done will interest all the world.



BARTON SWING AQUEDUCT.

Along the route of the canal are two or three insignificant converging streams which unite just below Manchester—the Irwell and the Mersey; the former flows through the city. The canal naturally follows the course of these rivers, for there the land is lowest, lying in their drainage valleys; and then, too, it was necessary to utilize the drainage waters of these rivers to furnish the necessary water to work the canal.

It was not practicable to build a canal at sea level, for the land rises as we go inland and the valleys of these rivers ascend as we go toward Manchester from tide water in the Estuary at Liverpool. In fact, the surface of the water at the canal docks in Manchester, as finally established by these requirements of nature, is over 60 feet higher than the ordinary water level of the canal at Eastham, its sea terminus. The same plan was followed as has been done under such conditions the world over from time immemorial. Level stretches of waterway of various lengths were established, and the 60 feet of difference of water level was overcome by locks— such as we see on the Erie, or Welland, or the Sault. It was found to be expedient to make four locks each of about 15 feet rise, to raise or lower the vessels this 60 feet. A vessel coming up from the sea would "lock up" through these four locks, and



PLAN OF IRLAM LOCKS.

one going from Manchester to the sea would "lock down." To accommodate vessels of different size, there are large locks for the big vessels and small locks for the little ones. An intricate and extended network of large canals ramifies over the whole adjacent country. They all connect with the ship canal. The barge canal of most importance to the ship canal company, and owned and operated by it, is the Bridgewater canal, built and formerly owned by the Duke of Bridgewater. There are fourteen canal systems, 750 miles in length, in communication with each other and with the ship canal.

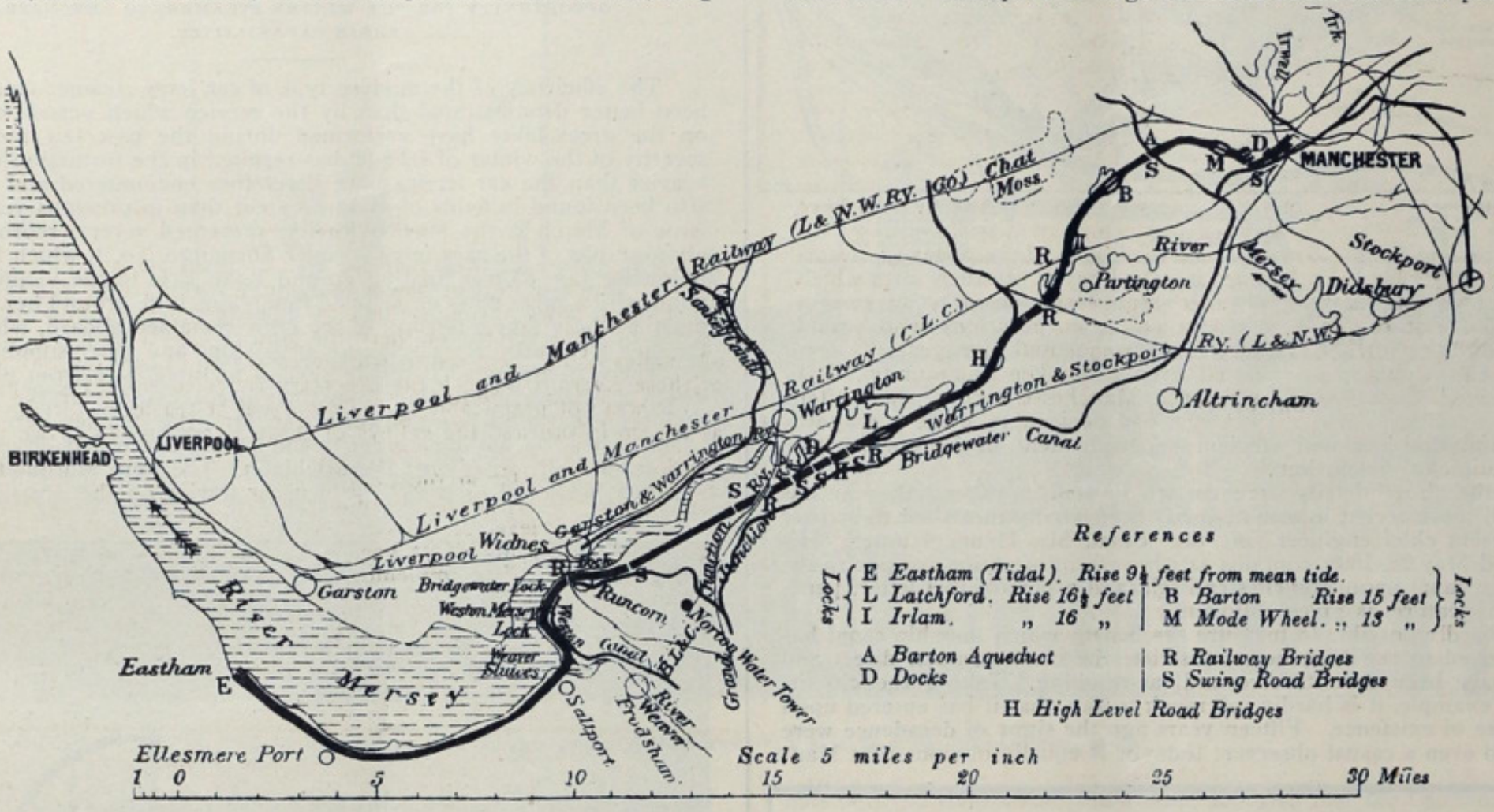
The important details of the docks at Manchester, with their extensive facilities for handling the various classes of freight, are interesting and worthy of examination. The water and wharf area of the docks is 256 acres, and the length of quay (or wharf) face is over five miles. Erected upon these wharves are 157 extensive warerooms and sheds, in forty-five separate buildings—certainly a good beginning of facilities for a large business. An inspection of all the work of the canal, its walls of concrete, masonry and brick, the moorings, the hydraulic power plant for working the cranes that handle the freight between the ships and the cars, sheds and warehouses, the buildings, and every kind of construction, shows that they are all made of the best materials, put together in a thorough and workmanlike manner. The canal is one of the very largest in the world, in fact the largest in some respects. Its great width strikes us at first glance. We know that the Suez canal, which does the largest business of any in the world, (except the Sault—Editor), has, until quite recently, been only 72 feet wide throughout most of its length; the Amsterdam canal, 88 feet; the projected and partly built Panama canal, only 72 feet; and that the new North Sea and Baltic and the Corinth canals have widths much less than the Manchester canal, which, except in one place, is 125 feet wide at the bottom. Three miles of it near Manchester is 170 feet wide. As most of the material through which it was built is earth, the slopes of the banks give considerably greater widths

*Read before the Western Society of Engineers.

than those at the surface of the water, being generally 172 feet, and, near Manchester, 230 feet.

There are, at the Irlam locks, a large lock and a small one, respectively 600 feet by 65 feet and 350 feet by 45 feet, with sluices, from three to five in number, at each set of locks, for allowing surplus flood waters to pass from lock to lock without passing through them and obstructing navigation. These locks, the gates and all the appurtenances, are built of the best material; and the hydraulic power and the openings for letting in and discharging the water at the lower locks are so well arranged that the largest vessels do not require more than ten minutes to enter the lock, shut the gate, let in the water, lift the vessel fifteen feet, open the upper gates and pass out into the next reach of canal. The sluices are arranged with rolling gates on the Stoney patent (named after the well-known engineer who designed them), so that they are raised or lowered to discharge a larger or smaller amount of water at the will of the operator. Although there is a tremendous water pressure on them, they move with perfect ease. The banks of the canal, where they are of earth, are revetted with stone to prevent them from being injured by the waves of passing steamers and tow boats.

Railroads, formerly crossing the line of the canal near the surface of the ground, have been raised by the most expensive constructions; long



GENERAL PLAN OF THE CANAL.

spans 137 to 266 feet, and high embankments; so that trains may go over the canal. These bridges are 75 feet above the water, so that steamers may pass under them. Main highways are carried over in the same way. The main trunk of the Bridgewater canal is carried across by a swing bridge, a movable aqueduct 235 feet long, 6 feet deep and 25 feet wide. The ends of the aqueduct, before it is swung around on the pivot pier, are closed by very ingeniously contrived gates worked by hydraulic pressure machinery. Then water and all are turned around at right angles, or parallel to the line of the ship-canal, so as to let the vessels pass through openings 90 feet wide. The weight of this swinging aqueduct bridge is 1,400 tons.

There are many other important and interesting features which we have no space to describe. The variety of work, its character to adapt it to the requirements, the skill in meeting different conditions, all strike one forcibly as the journey proceeds from Manchester to Eastham. Some idea may be formed of the immense amount of work done to provide a seaport for Manchester from the following facts. During the busy period of construction, the plant, labor and materials employed were as follows:

Steam excavators, etc.	100
Including.... 10 Floating dredgers.	
3 German dredgers.	
2 French dredgers.	
55 Steam shovels.	
Locomotives	173
Steam and other cranes	194
Portable and other steam engines	182
Steam pumps	209
Cars	6,300
Steam pile drivers	59
Length of temporary railways	223 miles
Number of laborers	16,361
Number of horses	196
Quantity of coal used monthly	10,000 tons
Quantity of cement used monthly	8,000 tons

These produced the following results:

Excavation, 51,000,000 cubic yards, or 76 million tons which, if loaded on a train of full-sized United States cars, would more than reach around the globe.

Brick work.....175,000 cubic yards, 70,000,000 bricks

Cut stone masonry .....220,000 cubic yards

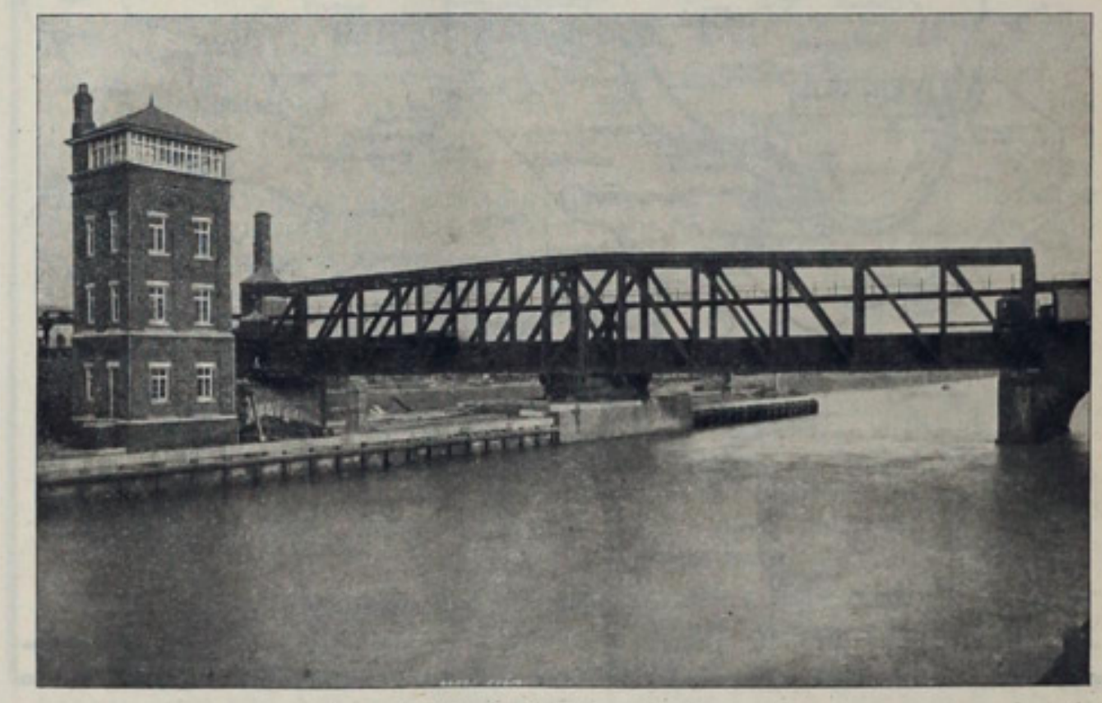
Concrete .....1,250,000 cubic yards

The company owns, along and near the banks of the canal, over eighty-five miles of permanent railroad tracks to handle the goods between the banks of the canal and other railroads, and on the wharves at Manchester and elsewhere. There were carried over these tracks 845,000 tons of freight in 1896. All the docks, wharves, warehouses and locks are brilliantly lighted by electricity for night work by ninety-four arc lights and nearly 800 high candle power incandescent lights.

As to the business of the canal, it is assuming proportions that give promise at least of great magnitude in the near future. Sea-going vessels to the number of 3,557 used it in 1896; in 1894 the traffic was 925,659 tons; in 1895, 1,358,875 tons; in 1896, 1,826,237 tons; 34 per cent increase between the two latter years.

The total revenue in 1896 was $899,000.00. It is of interest to note some of the items of the traffic in the year 1897: Cotton (season of 1896 and 1897), to June 1, 1897, 289,734 bales; textile manufactures, 150,000 tons; timber, 180,000 tons; coal, 220,000 tons; wood pulp and pulpwood, grain, flour, pig iron, iron ore, manufactured iron, etc., 355,000 tons; with thirteen other articles to make up the sum total. The sailing list shows that the steamers trading at Manchester go to upward of 150 ports. The list of thirty-five large vessels using the canal ranges from 3,058 gross tons to 4,640, and 2,010 net register tons to 3,000; their dimensions from 314 feet length to 410, 38 feet width to 48 feet, and 18 feet depth to 29 feet. The canal is so wide that at nearly all points large vessels can easily pass each other. The speed of large vessels is about six miles per hour, and of the smaller ones, eight miles. The whole passage from Eastham to Manchester requires about six hours on the average.

This, briefly, is the work and its results. As to the future, there can be little doubt of entire success, but the heroic patience and the hard work of the past needs to be continued for years to come. But, with the commercial advantages of the canal, there ought to be earned by the end of the next five years, at least a small dividend on the $75,000,000.00 of invested money. The development of traffic in the Suez canal is intructive and encouraging for Manchester and for all other canals which have a

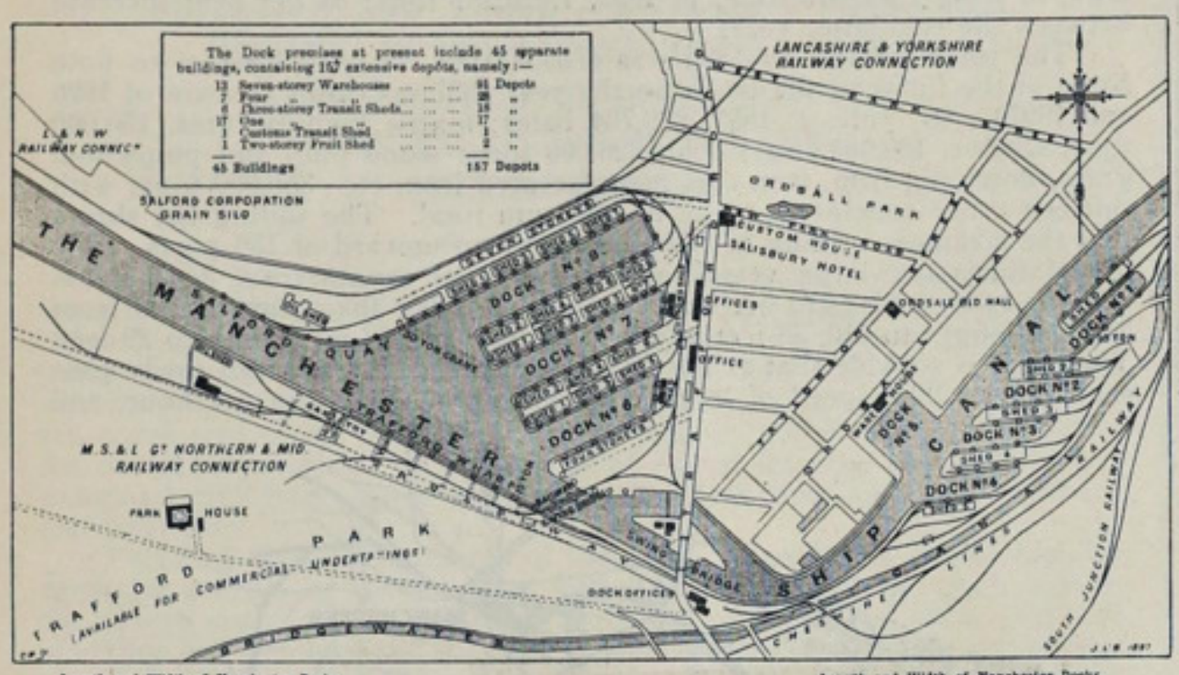


VIEW OF BARTON SWING AQUEDUCT BRIDGE.

raison d'etre. From small beginnings of traffic, Suez has crept up to over 8,000,000 tons and to about $16,000,000.00 revenue, returning to its founders and stockholders most satisfactory dividends. Manchester may not hope for so large an income, but she may hope for as large a traffic.

In addition to the great industrial and commercial interests to be benefited, and the population of over 7,000,000 already spoken of, it should be noted that two-thirds of the puddling furnaces and one-third of the rolling mills of Great Britain are in the territory tributary to the ship-

canal, and that nearly one-third of the machinery exports of the United Kingdom go to the world from the same district, which is well known to be unexcelled as a center of mechanical skill and industry. The time will come in the near future when the leaders of this project will be regarded as great benefactors; Daniel Adamson the founder and promoter of the enterprise; Marshall Stevens, the manager; and Sir Edward Leader Williams (knighted for the part he took in the work), the chief engineer



Length and Width of Manchester Docks.
No. 8 Dock is 1,340 feet x 250 feet.
" 7 " 1,160 " x 225 "
" 6 " 850 " x 225 "

Length and Width of Manchester Docks.
No. 4 Dock is 560 feet x 150 feet.
" 3 & 2 " 600 " x 150 "
" 1 " 700 " x 120 "

NOTES.

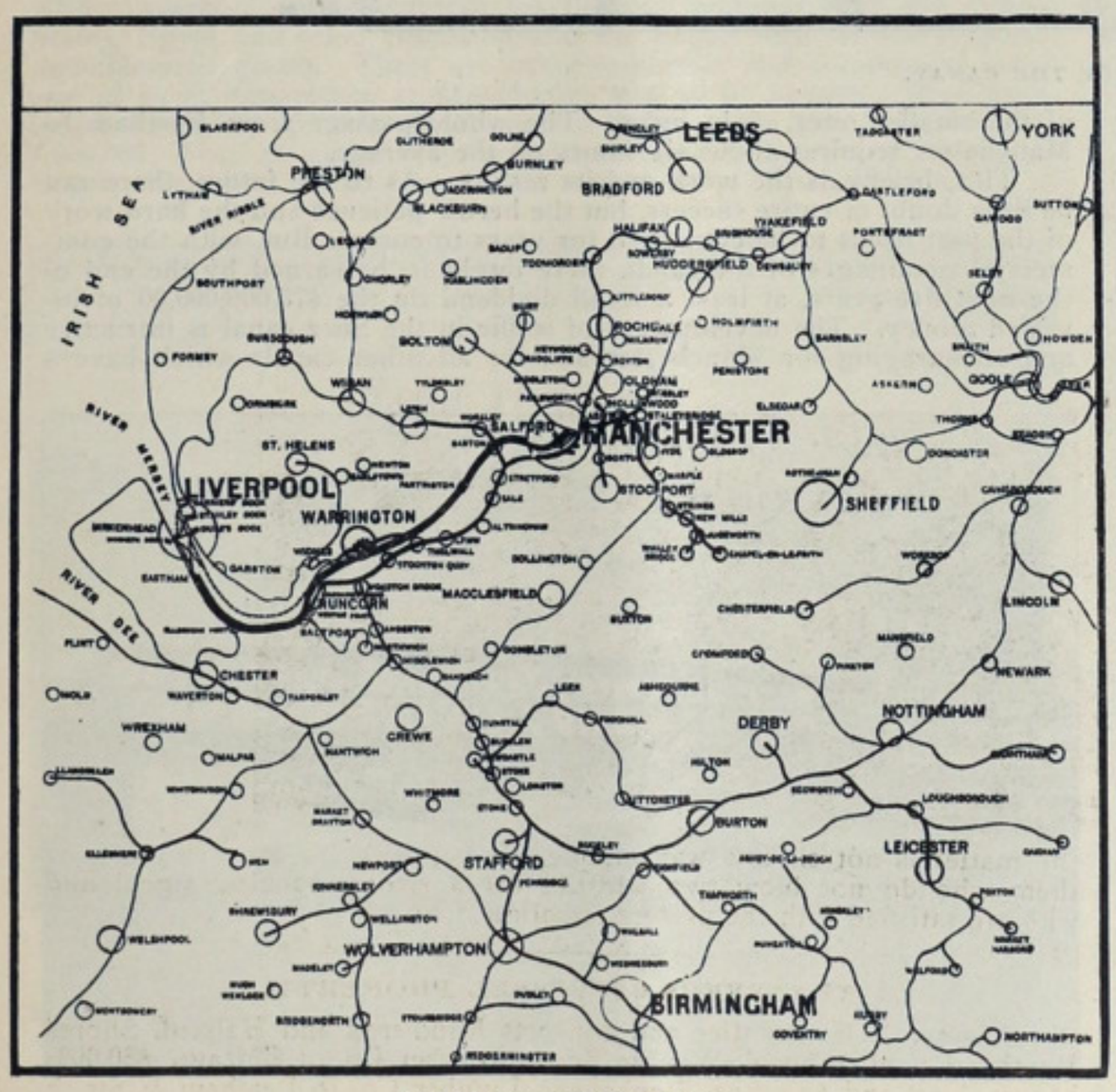
The Docks are equipped with Transit Sheds of new design, Hydraulic and Steam Cranes, and other appliances, for giving quick despatch in loading and discharging.
The Docks are in direct communication with the whole of the Barge Canals of the district.
The Railways of the Company convey traffic direct between the various loading and discharging berths at the Docks, and are connected with all the Railway Systems of the Country.
The Water and Quay area of the Docks is 256 acres. Length of Dock Quays is 5½ miles. The depth of Nos. 6, 7, and 8 Docks is 26 feet, and of Nos. 1, 2, 3, and 4, 20 feet. No. 5 is not yet excavated.
The Trafford Park Estate, adjoining the Docks, is now available for the establishment of various Commercial undertakings.

PORT OF MANCHESTER.

—the skillful designer and efficient superintendent of its construction from inception to conclusion..

Since the above details were written in 1897, another half year has passed, and more recent information has been kindly furnished the writer by the present chief engineer of the canal, Mr. Henry Hunter. His letter, dated May 28, 1898, contains satisfactory information relative to the effect of the canal upon Manchester itself, and a part of this letter, pertinent to this feature, is given following:

"It is hardly possible to measure the benefit which the ship-canal has already proved to the Manchester district; the consequences, direct and indirect, have been so extensive and far-reaching. Taking the city itself, as an example, it is hardly too much to say, that it has entered upon a new phase of existence. Fifteen years ago the signs of decadence were apparent to even a casual observer; today it is equally obvious that Man-



CANAL COMMUNICATIONS.

chester has renewed her youth. New industries of all kinds have sprung and are springing up; the building operations carried out and in course of progress are probably without precedent in this country, and it is not too much to claim that the change has been due to the ship-canal, as it is the only factor which has made for change during the last fifteen or twenty years."

The report of the chairman at the meeting of the shareholders Feb. 17, 1898, contains other matter of much interest and importance. From the revenue earned during the preceding half year, there was paid $183,715 interest on the first debentures and $44,325 on the second debentures. The amount of merchandise traffic reached in the year 1897 2,066,000 tons. The increase would have been greater except for the falling off in grain traffic, due to some special causes, since removed. It must be recognized that the canal while competing with a most determined and vigorous competition by railroads in Liverpool, is exerting a tremendous influence on the cost of transportation generally. Before the canal was projected, the dock dues on cotton at Liverpool were 3s. 6d; now they are 2s. The railway rate for cotton to merchants was formerly 9s; now it is 7s 2d. These are instances only of the effect of the canal on dues and rates. The canal will continue to exert a greater and greater influence. One of the largest manufacturers of Manchester has recently stated, that although one of the largest shareholders, and as such a loser in direct interest returns, the increase in his business and the general reduction in rates upon his incoming and outgoing products have more than repaid to him his entire interest in canal shares, and that others have profited equally as well.

ACHIEVEMENTS OF THE CAR FERRIES.

SEVERAL MONTHS OF VERY HEAVY ICE IN THE GREAT LAKES REGION AFFORDS OPPORTUNITY FOR THE WINTER STEAMERS TO DEMONSTRATE THEIR CAPABILITIES.

The efficiency of the modern type of car ferry steamer could not have been better demonstrated than by the service which vessels of this class on the great lakes have performed during the past few months. The severity of the winter of 1898-99 has resulted in the formation of ice much heavier than the car ferries have heretofore encountered and the ice has also been found in fields of greater extent than in previous years. In the issue of March 2, the Marine Review presented several reproductions of photographs of the cary ferry steamer Shenango No. 1, which for a month following Jan. 25 was floating around Lake Erie in the vicinity of Long point with a great mass of ice piled mountains high around her. Throughout the whole time a portion of the crew remained aboard, while some of the men went ashore each day for provisions and other supplies.

There is presented herewith several pictures, also from photographs, which are more interesting than their predecessors, for the reason that they represent a far more powerful car ferry, the steamer Pere Marquette, which instead of getting caught in the ice has succeeded in keeping navigation open all winter on Lake Michigan. The Pere Marquette is among the most powerful of some fourteen car ferries on the great lakes. She

STEAMER PERE MARQUETTE WITH CAR FERRIES FOLLOWING.

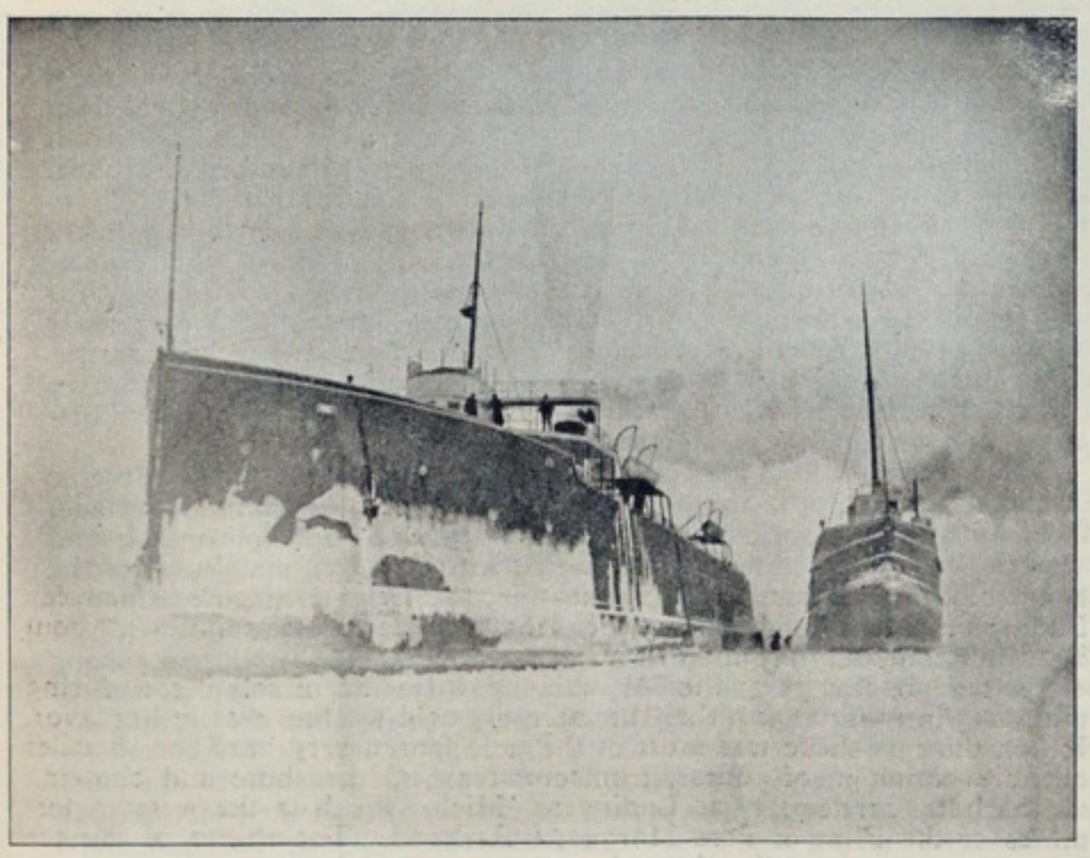
was one of the vessels that served as an object lesson for Russian government officials who visited this country a short time ago for the purpose of making investigations regarding ice-crushing steamers. The Marquette was built by F. W. Wheeler & Co. of West Bay City, Mich., and is 350 feet in length, 56 feet breadth, and 36 feet 3 inches depth from keel to upper deck. When loaded with thirty freight cars this vessel displaces 4,050 tons on a draught of 12 feet 3 inches. She is capable of attaining a speed of 16 miles an hour in open water and has a record of 10 miles an hour continuously through 14 inches of solid ice. Her route is between Ludington, Mich., and Manitowoc, Wis., a distance of 56 miles. About 3½ hours is usually required to make the trip.

A strange feature connected with the operation of this vessel during the past winter is the fact that the intensely cold weather was in her favor. Ice on the east shore was most of the time frozen very hard for 15 miles out, preventing it, of course, from crowding on the shore and blocking the harbors, particularly at Ludington, Mich., which is the western terminus of the Flint & Pere Marquette Railroad. The ability of the car ferry steamer to keep the channel open was a most fortunate circumstance for the Milwaukee boats, for the ice being thin on the west shore of Lake Michigan, the Milwaukee boats made a practice of going down that shore to Manitowoc and then following the car ferry's channel across. One of the photographs, which we are enabled to present through the courtesy of Mr. Robert Bruce, chief engineer of steamships of the Flint & Pere Marquette Railroad Co., shows three of the company's wooden steamers, Nos. 3, 4 and 5, following the big car ferry across, and the other picture depicts the steamer No. 2 fast in the ice, where she was compelled to remain until the Pere Marquette came along and released her. The ice on the east shore ranged from 12 inches of hard blue ice to 15 feet of snow ice where

it had winrowed. The Pere Marquette was not over forty-eight hours in making any one trip and ran almost uninterruptedly throughout the entire winter.

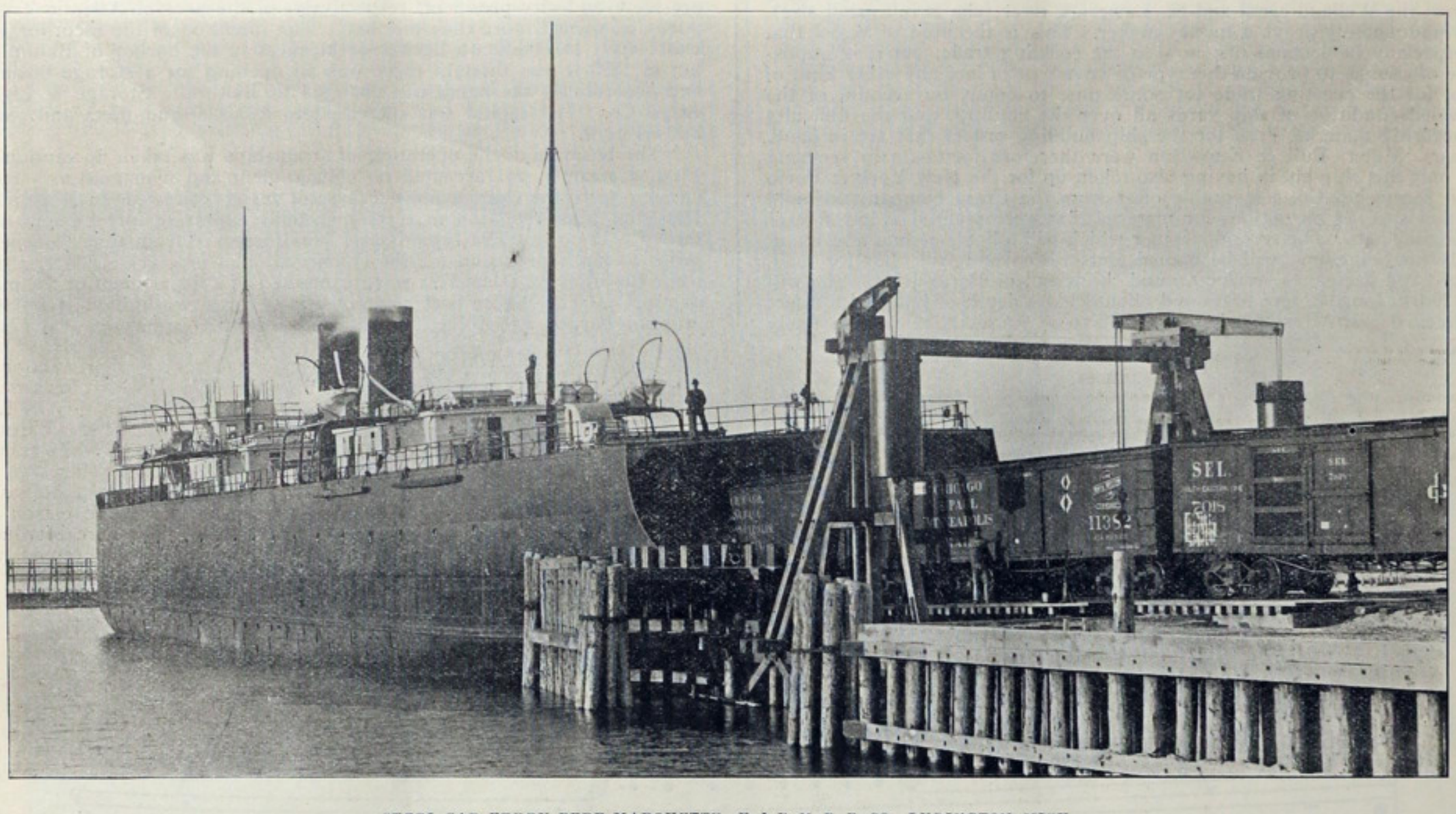
A tabulated statement recently published by N. B. Conger of Detroit, chief of the lake department of the United States weather bureau, shows very clearly that ice all through the upper lake region has been much heavier during the past winter than in any year for a long time past. The weather bureau reports are conclusive on this score, but it is not necessary to reprint them, as there is sufficient evidence in the fact that there are no signs as yet of a general opening of navigation, although the lake fleet was well under way at this time a year ago.

In connection with this reference to the work of carry ferry steamers on the great lakes a word may be said regarding the great interest that has been aroused abroad in ice breaking steamers. The Russian steamer Ermack was described and illustrated in a recent issue of the Review, and later particulars were given relative to the official trial of that vessel. Now comes the report of a not less favorable showing made by the ice breaker Sampo, which was recently furnished to the Finnish government by Armstrong, Whitworth & Co. of England. According to reports just received this vessel went through pack ice that was in places 20 feet thick.



CAR FERRY STEAMER PERE MARQUETTE IN THE ICE.

In one case the sheet of ice was about 6½ miles broad, yet the engines drove the ship through it at a mean speed of 3½ miles per hour. The slide valves were in normal gear and all main stops and throttles full open. The steam pressure was 160 pounds and the one engine made sixty-eight revolutions, and the after engine sixty. Many times the fore engines came to a stop when the ship went at full speed against the masses of ice, but only for about a minute, and then they gradually got away again. The propeller at the bow proved a grand idea for ice-breaking, for as soon as the ship stops the rotating screw propeller clears the ice away or puts so much water on the top of the ice as enables the ship to move astern as soon as the engines are reversed. A new boat, named the Arcturus, built in Dundee, of 4000 indicated horse-power, was completely jammed until the Sampo broke her out, and then it took nine hours to get the steamer clear of the ice, although it was only six miles broad.



STEEL CAR FERRY PERE MARQUETTE—F. & P. M. R. R. CO., LUDINGTON, MICH.

THE TWO-WHISTLE SIGNAL.

Some members of the Cleveland lodge, Ship Masters' Association of the Great Lakes are engaged in an effort to have the United States board of supervising inspectors of steam vessels change the rules for signals between pilot house and engine room so that the two-whistle signal, no matter how many times repeated, and even if the ship is backing, will always mean to back. This agitation is the result of letters that recently passed between the firm of Pickands, Mather & Co. of Cleveland and the supervising inspector general, James A. Dumont. It is well known, of course, that on a great many steamers the two-whistle signal is used for a strong backing signal, although the rules provide that when the engines are backing the signal to back strong should be one long whistle or four bells. Gen. Dumont declared very plainly in the correspondence referred to that the use of two whistles for a strong backing signal is in violation of law. The Cleveland captains who are now objecting say:

"It is our opinion that the law intended the two whistles to mean back, and back at all times, irrespective of other signals that might have been blown previously. Repetition of this signal is the only safe course. The master or pilot then has one signal upon which he may depend as having but one meaning, no matter how often repeated. It happens many times from noise and other causes that the captain does not hear distinctly the signals blown, especially upon vessels of over 400 feet in length. Such vessels do not show by vibration or in any other way when in tight places whether their engines are working or not, or whether they are working ahead or astern, and from the great weight of these vessels it is very difficult to determine at all times from their momentum the direction in which they are moving."

It is proposed to urge in all the lodges of the Ship Masters' Association on the lakes the adoption of resolutions objecting to the ruling of the supervising inspector general, and if the movement is successful to take the question before the board of supervising inspectors at its next meeting in January, 1900. It may be well to note, however, that opinion in the matter is not all one way among the captains. There are many of them who do not blow two whistles for a strong backing signal and who are satisfied with the present situation.

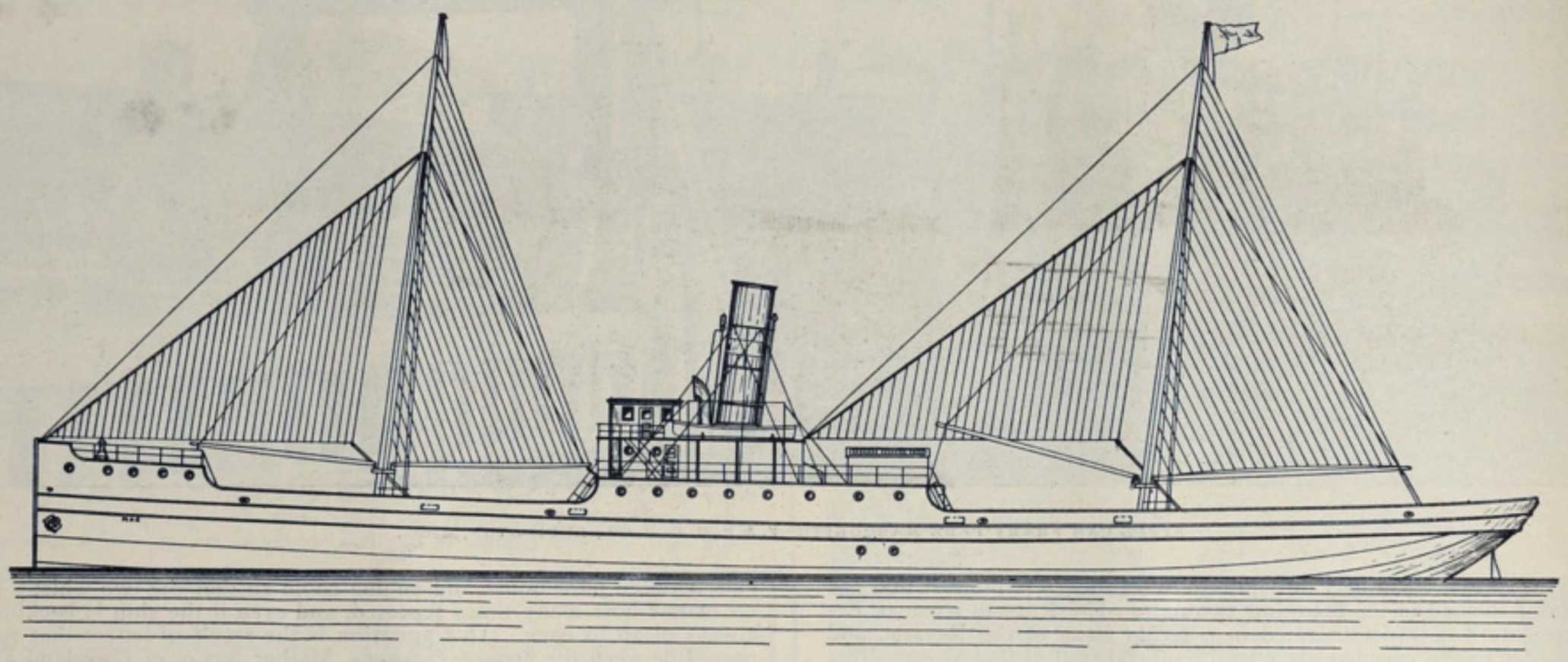
TRANSFERS OF VESSEL PROPERTY.

Steamer J. H. Prentice and consorts Middlesex and Halsted, Shores Lumber Co. of Ashland, Wis., to Soper Lumber Co. of Chicago, $30,000; barges Alert and Advance, Stephenson Lumber Co. to Leathem & Smith of Sturgeon Bay, Wis.; passenger steamer Juliet, Benjamin Shurtleff of Chicago to Chicago drainage canal trustees.

FOR PORTO RICO SERVICE.

LAKE SHIP BUILDERS CONTRIBUTING A COUPLE OF STEAMERS FOR THE RAPIDLY DEVELOPING TRADE OF THE ATLANTIC COAST AND WEST INDIES.

A steel screw cargo steamer, built on the great lakes but planned in all respects for ocean service, is illustrated herewith. The vessel is the Mae, which will be launched about April 15, at the works of the Craig Ship Building Co., Toledo, and which was sold a short time ago to Miller, Bull & Knowlton, Hanover Square building, New York. With freights to the West Indies and along the Atlantic coast in the condition they are now, this vessel, which will go on down to the coast in the early spring by way of the Welland canal and St. Lawrence river (she is full canal size), will undoubtedly prove a money-maker. This is the kind of vessel that is especially in demand just now in the coasting trade, but it is impossible of course, to provide this type of vessel, or in fact any other kind of ship, for the coasting trade for some time to come, on account of the crowded condition of ship yards all over the country, and the difficulty in securing material, even for the ship building orders that are in hand. Messrs. Miller, Bull & Knowlton were therefore fortunate in securing not only this ship but in having also taken up for the New York & Porto Rico Steamship Co. a favorable offer from the Craig company to build another stea er on options for material that were secured at low figures some time ago. The second steamer which will follow the one now about ready for launching, will be named Porto Rico and will be for mail, freight and passenger service around the island of Porto Rico. She will be 220 feet long, 32 feet beam and about 21 feet depth of hold, with 8 feet between decks. Her speed is to be 12 to 13 knots. She will be finely



STEAMER MAE BUILDING BY CRAIG SHIP BUILDING CO., TOLEDO, O., FOR THE PORTO RICOAN SERVICE OF MILLER, BULL & KNOWLTON OF NEW YORK.

fitted up in every particular for about thirty first-class and twenty-five second-class passengers, with electric lights throughout and every modern convenience. Miller, Bull & Knowlton also have building at Wilmington, Del., two other steamers, the Ponce and San Juan which will be ready next fall for the Porto Rico Line.

In the steamer Mae, which was first put down in the Toledo yard on builders' account, but afterward changed in design to be in every way suited to the Atlantic coast trade, the New York firm has undoubtedly secured a bargain, principally for the reason that they got her at a price based on the cost of steel for her construction before the recent heavy advance had taken place. They are employing John Haug of Philadelphia, the well-known naval architect and Lloyd's representative there, in the construction of the steamer, and every part of her is being built subject to his approval. She will also class A1 in the Record of American and Foreign Shipping.

Particulars of the Mae are: A steel single screw steamer of 2,100 tons gross and 1,200 tons net; length over all, 263 feet; beam 42 feet; moulded depth, 25 feet; speed, between 10 and 11 knots per hour when loaded; consumption, about 20 tons per 24 hours; wooden 'tween decks laid throughout; mean draft, fully loaded, 19 feet; dead weight capacity, about 3,000 tons; cubic capacity, about 130,000 feet for cargo; bunker capacity, 350 tons; steam steering gear; steam windlass; four Lidgerwood hoisting engines and connections; large donkey boiler, 9 feet long by 7½ feet diameter, capable of driving all winches at once; four hatches, two 16 x 20 feet, and two 16 x 16 feet; water ballast in cellular double bottom; four watertight steel bulkheads; evaporator and ash ejector; copper and brass piping throughout; bilge keelsons, 125 feet long on each side; Ellis & Eaves induced draught, giving greater speed and reduced consumption and taking up less room in steamer, thus giving more cargo space; triple expansion, surface condensing engines, with cylinders of 22, 37 and 61 inches diameter with 36 inches stroke; steam pressure, 175 pounds; two steel boilers (Scotch type), 12 feet 6 inches by 12 feet; steam starting and reversing gear.

A comparison between explosion and expansion engines for launches has recently been made under government supervision in Germany, and the result was decidedly in favor of oil motors as against steam. The cost of the oil boat was only two-thirds of that of the steam vessel and the equipment weighed only 2 tons as against 4 tons for the steam outfit. To offset these advantages there was only one point in favor of the steam launch and that was in the matter of speed.

SERVICE OF THE ATLANTIC TRANSPORT CO.

Announcement of the completion in the near future at the yard of Harland & Wolff, Belfast, Ireland, of the four large twin-screw steamers building for the Atlantic Transport Co. has called attention in an emphasized degree to the efficiency of the service of that line. The new vessels, which will be larger and speedier than those at present operated by the company, will be called the Minneapolis, Minnehaha, Minnetonka and Minnewaska, the latter a namesake of the old Minnewaska, sold to the government. The history of the Atlantic Transport line is quite a fascinating business romance. The incorporation was in 1881 under the title of the Rohrer Scow Co., with a paid up capital of a little less than $50,000, of which Messrs. Bernard N. Baker and James S. Whiteley, the president and vice-president, respectively, of the present Atlantic Transport Co., owned more than one half. The intention of the incorporators was merely to conduct a lighterage business in the harbor of Baltimore, but in 1883 it was thought there was an opening for a storage business and accordingly the name was changed to Baltimore Storage & Lighterage Co. The capital was increased to $200,000 and piers and warehouses built.

The business of the operating of steamships was taken up cautiously. First, a steamer was accepted on consignment and managed on a commission basis, the charter and purchase of vessels followed. In November, 1886, the Maryland, the first steamer built expressly for the line, was turned over to it. The capital stock was increased from time to time in order to make provision for the construction of new vessels, but all the while the lighterage business was maintained as a department of the main enterprise. The harbor fleet now consists of forty-two lighters, two large railroad barges and three tugs. The Atlantic Transport Co. later branched out in the operation of a line from Philadelphia to London, and continued to grow until it has today a paid-up capital of $3,000,000 and is absolutely free from bonded indebtedness or mortgage of any sort.

When the United States at the outbreak of the Spanish-American war, found it necessary to form quickly an extensive auxiliary naval fleet, more vessels were purchased from the Atlantic Transport Co. than from any other line. The purchases included the steamers Minnewaska, Mobile, Mohawk, Manitoba, Massachusetts, Mississippi and Michigan. All of these have been renamed and retained as permanent transports, being thoroughly refitted therefor, as described in the issue of the Marine Review two weeks ago. President Baker also loaned to the government for use as a hospital ship the steamer Missouri, which was already possessed of an excellent record as a good Samaritan, having been instrumental in the rescue of 700 persons from the sinking steamer Danmark in April, 1889, and having also carried a cargo of flour free to the Russian government for the famine sufferers in March, 1892.

The present fleet of the company consists of the steamers Mesaba, Marquette, Menominee, Manitou, Minnesota, Maine, Montana, Maryland, Mackinaw and Missouri. The Atlantic Transport Co. also controls and manages the National line from New York to London, consisting of the steamers Europe, America and Manhattan, the latter a cargo steamer of 12,000 tons capacity, which made her first voyage early this year. At Philadelphia, in addition to its own line to London, the Atlantic company has the agency for the Hamburg-American line to Hamburg, and at Baltimore, in addition to both these, the company has the agency for the Lord line to Belfast and Dublin, the Empire line to Leith, and the Bristol Channel line to Bristol. The fluctuating demands of the business has frequently made it necessary to charter vessels for short periods. For instance, during the past six months the company has had under charter no less than thirty different steamers. Officers other than those given above are: Treasurer, Charles G. Heim; secretary, Waldo Newcomer; general manager, P. A. S. Franklin of New York City.

The fact that within three weeks recently five boiler tubes burst on the British cruiser Terrible (Belleville boilers) has given rise to the suspicion that the metal has deteriorated and a rigorous periodical inspection is being urged. In the opinion of the assistant engineer of the Terrible, welded tubes may be expected to give way in shorter time than solid-drawn tubes.

ELEVATORS AT FORT WILLIAM.

FOUR SPLENDID STRUCTURES WITH AN AGGREGATE CAPACITY OF 5,250,000 BUSHELS OF GRAIN ERECTED BY THE CANADIAN PACIFIC RAILWAY CO.

Through the courtesy of Mr. M. Sellers, the representative of the Canadian Pacific Railway Co. in charge of extensive grain elevator interests at Fort William, Ont., the Marine Review is enabled to present a group of photographs of the elevators. The prominence which Canadian routes and Canadian transportation interests have recently assumed in the northwestern grain trade makes reference to the subject especially timely. The Canadian Pacific Railway Co. began the consolidation of its various interests at Fort William in 1890. Previous to that time the principal works of the company were located at West Fort William, and the chief offices and the port for the transhipment of all freight from lake to rail was at Port Arthur.

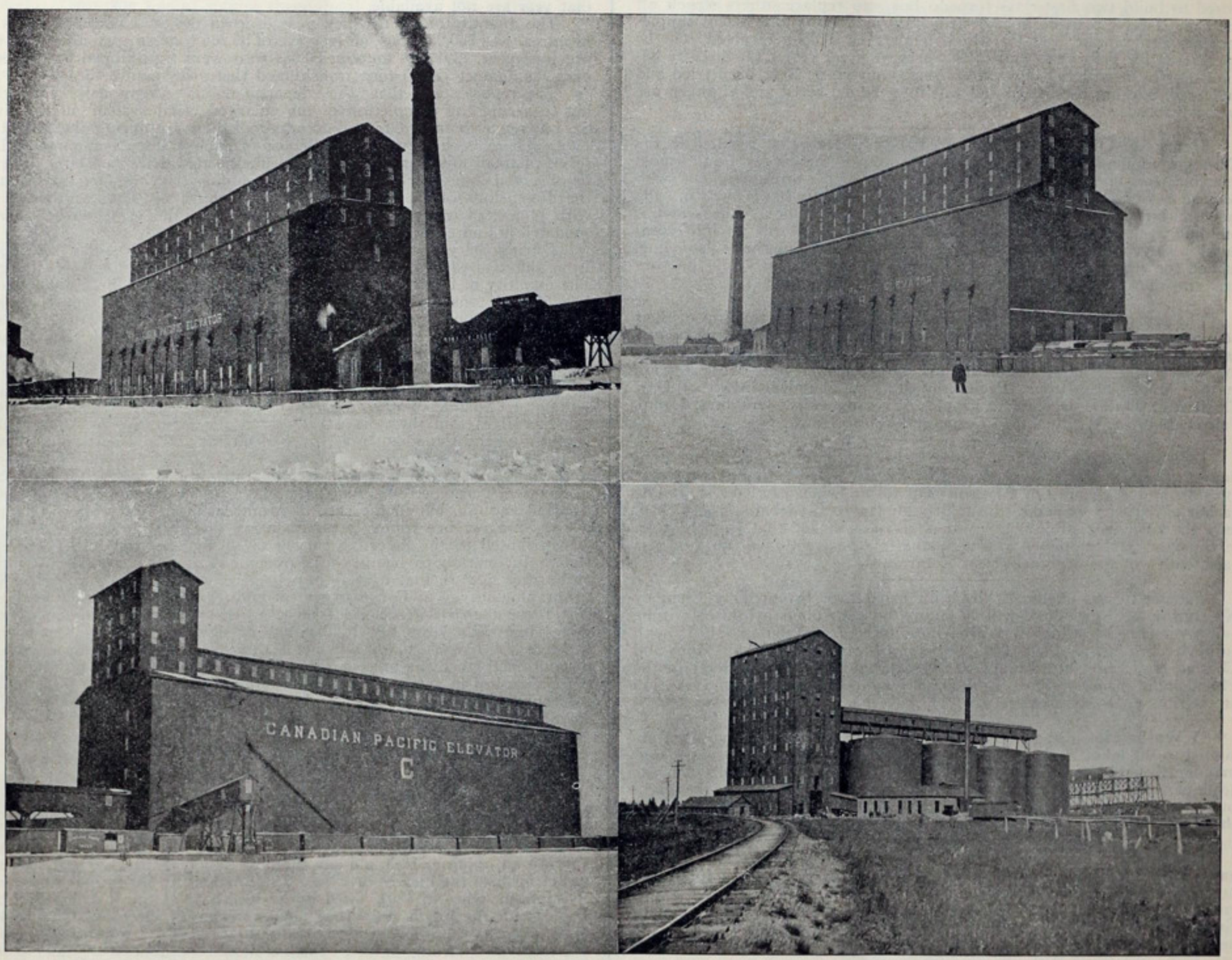
The business had not been greatly developed, however, before the officials of the company perceived the natural and economic advantages offered by the Kaministiquia river for the concentration of the entire business on Lake Superior, and a well defined policy was soon after mapped out for the process of centralization by means of the erection of mammoth elevators, the construction of good docks, etc. Beginning with the spring of 1891 all lake freight and passengers were landed on the wharves of the Kaministiquia, and Fort William was made the connecting point between lake and rail—the northwestern terminus of navigation. All the works and business of the company formerly carried on at the west end and Port Arthur were thus brought together at Fort William, where over $1,000,000 had already been expended in improvements.

Improvements since undertaken have brought the total up to full $2,000,000. The four elevators alone have entailed an expenditure in excess of $1,000,000. The elevators, which are the largest in Canada, are designated A, B, C, and D. The three first mentioned are each 325 feet in length by 90 feet in width and all are equipped with the latest improved type of machinery. Capacities are as follows: Elevator A, 1,200,000 bushels; elevator B, 1,300,000 bushels; elevator C, 1,250,000 bushels. The fourth elevator, D, is the new steel tank structure, and has a capacity of 1,500,000 bushels, bringing the aggregate up to 5,250,000 bushels of grain as the capacity of the four elevators.

The steel tank elevator D, was erected in 1897-98 and is the first and only elevator of this unique design in Canada. It consists of twenty-four cylindrical steel storage tanks, 60 feet in height. Eight of the tanks are each 58 feet in diameter, while the diameter of each of the remaining sixteen tanks is 29 feet. They are absolutely fire and damp proof and have been rendered impervious against rats, insects, etc. The main building, which is of structural steel, contains modern machinery for cleaning, separating, weighing and transferring grain from cars to tanks or vessels. The shipping capacity is 40,000 bushels per hour and the unloading capacity 400 cars per day. The elevator has attracted considerable attention by reason of the fire proof arrangement which obviates the necessity of insurance and the very excellent plan for the separation of the storage department from the machinery for handling and weighing the grain.

Other facilities of the Canadian Pacific company are in keeping with the completeness of the elevator equipment. For the storage of package freight delivered by the steamship lines there are two sheds, each 500 feet in length. The company also has an unbroken line of more than 4,000 feet of docks. The coal docks alone have a river frontage of 1,200 feet, and upon them are landed annually more than 150,000 tons of coal.

The prospects for the future of Fort William as a grain shipping port are of the brightest. During the season of 1895 there were shipped from Fort William 10,587,866 bushels of wheat; during the season of 1896, 12,689,000 bushels, and during the season of 1897, 17,600,000 bushels. Of the quantity of the latter year 12,928,000 bushels were shipped for export by way of Buffalo, the bulk of it in American bottoms, while 2,000,000 bushels found its way to the seaboard via Montreal. The figures for 1898, 9,218,000 bushels, show a falling off, but the loss was due to temporary conditions.



THE CANADIAN PACIFIC RAILWAY COMPANY'S GRAIN ELEVATORS AT FORT WILLIAM, ONT.

The Perth Amboy Dry Dock Co. of Perth Amboy, N. J., recently launched a 2,500-ton floating dry dock built to replace the one sold to the United States government during the war with Spain. The new dock which was designed by J. D. Rankin, superintendent of the company, is 175 feet in length, is sheathed below the water line with inch pine creosoted, and is so arranged as to distribute the weight of a vessel evenly over the whole structure.

On two sections of the Chicago drainage canal more than 2,000 men are now at work, with favorable prospects for its completion next autumn. It is expected that the alterations in the dams and locks in the old Illinois & Michigan canal will be completed before the opening of navigation.

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Mr. Goshen, first lord of the British admiralty, refers to the "determined policy of a peace loving nation" in his latest announcements regarding new ships. The policy is certainly of a determined kind. According to the naval estimates for 1899-1900 it is proposed to begin the construction in government dock yards of two battle-ships (design not decided), two armored first-class cruisers, 9,800 tons, three smaller cruisers (design not decided), and two sloops, the latter twin-screw vessels of moderate draught, suitable for river service. By contract it is proposed to build two first-class torpedo boats to replace others struck off the list. Twelve torpedo boat destroyers provided for in a recent supplementary programme, and for which tenders have been received, will be contracted for before the end of the present fiscal year. Of the fifty 30-knot destroyers ordered in previous years, thirty-one have been tried and delivered, one has been tried and will soon be delivered and eighteen are well advanced.

Henry W. Oliver, who engineered the big deals that resulted in the Carnegie company securing control of some of the largest and most valuable iron mining properties of the Lake Superior region, and who became rich himself through the transactions, is to have one of the largest iron ore carriers of the lakes named in his honor. The vessel is building at Lorain for the Wilson Transit Co., and will go into commission early in the coming season. Another vessel of the Wilson line, named for Andrew Carnegie, was also among the largest of the ore carriers when she went into commission some time ago.

The Japanese have clung to many traditions in the formation of their new navy, and not the least of them is found in the poetical and picturesque names which have been bestowed upon the recently constructed torpedo boats. Among the latter are Dragon Fly, Full Moon, Moon in the Clouds, Sea Beach, Peewit, Lightning, Thunder, Dawn of Day, Clustering Clouds, Daybreak, Ripples, Evening Mist, Dragon's Lamp, Falcon, Magpie, White Naped Crane and White Hawk.

Development of the Clyde as the great center of ship building continues. The huge schemes projected by the Clyde trust for increasing the quayage and dock area of Glasgow will result, when carried out, in the harbor of that city extending from Broomielaw to Clydebank, a stretch of fully six miles in a straight line. It is also announced that John Shearer of Glasgow has completed arrangements for the erection of an immense yard, with wet and dry docks near Renfrew.

Patents of the pneumatic high-lift canal lock invented by Chauncy N. Dutton of New York will in future be controlled by the Maritime Improvement Co., which has been incorporated at Trenton, N. J., with authorized capital of $3,000,000. Amzi L. Barber, the asphalt king, and Charles H. Cramp are among the incorporators. In interviews in the Philadelphia papers quite enthusiastic endorsements of the invention are attributed to Mr. Cramp.

A Washington dispatch says that ten more gas buoys have been assigned to the lakes, eight of them going to the district in charge of Commander Kennidy of Detroit and two to the Lake Michigan district, the headquarters of which are at Chicago. It is probable that the eight buoys assigned to Commander Kennidy will be used almost entirely on the Sault river at points where they will displace private lights.

Commodore Harrie Webster, U. S. N., estimates that it cost the navy department of the United States fully $150,000 annually for docking and repairs to naval vessels due to barnacles. The United States cruiser Bennington, after having been in the harbor of La Union, Guatemala, for only sixty-three days, was found to have one of the heaviest accumulations of barnacles ever known.

Very heavy dividends, ranging in fact from 13 to 24 per cent., were paid last year by some of the German steamers belonging to Wismar. The German Levant line paid 9 per cent. as against 6 per cent. in 1897; the Neptune Steam Navigation Co., 12 per cent. as against 10 per cent. the year previous, and the German Steam Navigation Co. of Kosmos, 9 per cent. as compared with 7½ per cent. in 1897.

A late list covering the orders of the British admiralty in Belleville boilers shows a total of fifty vessels equipped with these boilers (finished or building), the horse power aggregating 768,500. This covers the operations of the admiralty in boilers during a period of six years just past. Among the latest orders is an aggregate of 120,000 horse power for four iron clads.

Harry Corby, a member of the Canadian parliament, announces that he proposes to build at Belleville, Ont., an elevator with a capacity of from 500,000 to 1,000,000 bushels, provided connection can be established for northwestern grain to be transhipped via that point.

The United States naval register for 1899, a copy of which is just to hand, shows that there are at present on the active list twenty-one naval constructors, sixteen assistant naval constructors and eighteen civil engineers.

CANADA'S CANALS.

COST OF CONSTRUCTION AND MAINTENANCE—TRAFFIC OF THE WELLAND—REPORT OF THE MINISTER OF RAILWAYS AND CANALS.

Ottawa, Ont., April 4.—The annual report of the department of railways and canals shows that the total expenditure charged to capital account on the original construction and the enlargement of the several canals of the Dominion of Canada is $72,504,401. A further sum of $15,067,096 has been expended for repairs and maintenance. The total revenue derived, including tolls and rentals of land and water powers, was $11,710,240.

On the Welland canal last year 1,274,292 tons of freight were moved, of which 824,485 tons were agricultural products and 181,817 tons produce of the forest. The quantity passing eastward was 1,050,093 tons and the quantity passing westward 224,199 tons. Of the 1,244,750 tons of through freight, Canadian vessels carried 345,977 tons, an increase of 4,847 tons, and United States vessels 898,773 tons, a decrease of 3,692 tons as compared with the previous year. The total freight passing through the canal from United States ports to United States ports was 564,694 tons, a decrease of 88,519 tons as compared with the year 1896. In regard to this last item a comparison cannot be made with 1897 as the figures for that year are not available.

The quantity of grain which passed down the St. Lawrence canals to Montreal was 560,254 tons, an increase of 99,205 tons as compared with the previous year. Of this amount 89,659 tons were transhipped at Ogdensburg, as against 77,355 tons transhipped there the year before.

The report states that the department is strenuously endeavoring to secure the completion of the enlarged canal system on the river St. Lawrence to such extent as to admit of their use during the season of 1899. There is, however, little chance of such a hope being realized, a series of small mishaps having caused unexpected delay last fall. It is to be observed that the chief engineer lays emphasis on the fact that though the dimensions of the enlarged locks are length 270 feet, width 45 feet, with 14 feet of water on the sills, the length of the vessel to be accommodated is limited to 255 feet.

During the year the number of vessels reaching Canadian lake ports from the United States was 18,777, carrying 1,919,416 tons of freight. The quantity of freight carried by boat from Canada to the United States was 512,668 tons. The word "ton" in Canadian official reports means always 2,000 pounds. The number of boats built in Canadian yards was 219, of which 109 were sail vessels. The total tonnage of the 219 was 22,426. Only thirteen of these boats were intended for service on the great lakes.

A higher rate of insurance is to be levied in future on ocean vessels sailing to Canadian ports. This is the result of several recent costly accidents. It is said there have been twenty wrecks on the Atlantic this winter, and the Canadian trade has had far more than its fair percentage of them. The Castilian is, of course, in everybody's mind, but there were many others which attracted comparatively little public attention but which were very costly to the underwriters. The dangers of the Atlantic are bad enough, but in the case of Montreal there is the special danger of the St. Lawrence route. Vesselmen say that these heavy losses are to be attributed to the defective survey of the coastal waters. There is a strong inclination to blame the government in the matter, and marine authorities declare that it is absolutely necessary to have a complete hydrographic survey of Canadian waters and new charts to guide mariners. The present charts are based largely on the work of Admiral Bayfield, done about fifty years ago in the time of slow sailing vessels and small tonnage. A partial survey was made three years ago, but the work was discontinued when the present Liberal government obtained power. This discrimination in rates will greatly hamper St. John, N. B., in its effort to become a great winter port, and will give a corresponding advantage to Portland, Me.

INVENTION OF THE MARINE ENGINE.

W. Clark Russell, well-known British writer on marine subjects, in the course of a late contribution to the Pall Mall magazine, gives the following opinion regarding the invention of the marine engine: "The invention of the marine steam engine has a vast number of claimants. One looks around the crowd bewildered. If I may, with the utmost modesty, venture an opinion, I should say that the first man to give practical and useful form to the idea of driving a wooden hull by steam machinery was Symington, who, in 1801, fitted up a steamboat at the instance of Lord Dundas for the Forth and Clyde canal company. She towed two vessels of an aggregate burden of 140 tons, at the rate of 3¼ miles per hour, in the teeth of a strong breeze. Justice should be done to John Fitch, however, an American, who so early as 1784 had obtained rights to run steamboats on the waters of Virginia and Maryland. His partner was one Rumsey. Afterwards the states of Pennsylvania and New York granted Fitch exclusive rights in the use of their waters. His boat was of 9 tons, and his engine drove her 5 miles an hour. He failed for want of money, and died by his own hands in 1798. One who knew him says he could think of nothing but his steamboat, and he fell into rags and broken boots through wandering about talking of her. The same authority says that he met him at the house of a boat builder, a man named Wilson, with whom was associated his blacksmith, Peter Brown, where, after indulging himself for some time in his never-failing topic of deep excitement, he concluded with these memorable words: 'Well, gentlemen, though I shall not live to see the time, you will, when steamboats will be preferred to all other means of conveyance, and especially for passengers; and they will be particularly useful in the navigation of the river Mississippi.' He then retired; on which Brown, turning to Wilson, exclaimed in a tone of deep sympathy, 'Poor fellow! what a pity he is crazy!'

The recent trial of the Pathfinder, built at Lewis Nixon's Crescent Ship Yard, Elizabethport, N. J., for the United States coast and geodetic survey, demonstrated conclusively the good qualities of the steamer. Her contract called for 12 knots an hour at 118 revolutions. On the trial she made 12.65 knots with 116 revolutions under natural draft and 13.35 knots under forced draft.

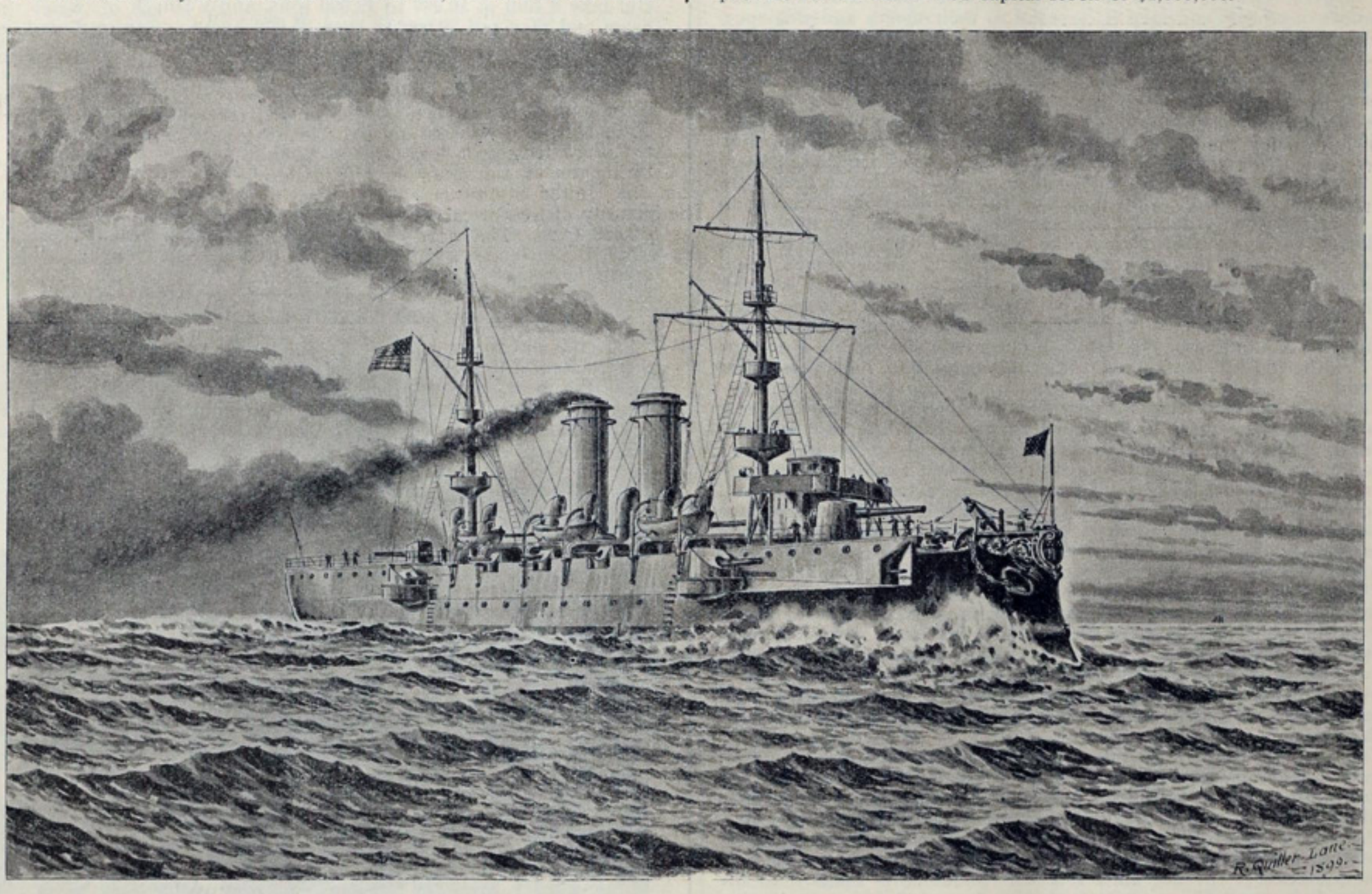
OUR NEWEST CRUISER.

THE ALBANY, RECENTLY LAUNCHED AT THE YARD OF ARMSTRONG WHITWORTH & CO., AT ELSWICK, ENGLAND—FOREIGN-BUILT VESSEL FOR THE UNITED STATES NAVY.

The subject of the latest drawing made for the Marine Review by R. Quiller-Lane, the English marine artist, is the cruiser Albany, which was recently launched at the yard of Armstrong, Whitworth & Co., at Elswick, England. Save for her sister ship, the New Orleans, which alike to the Albany, was purchased by the United States government during the Spanish-American war, this new-comer will be unique in the American navy as a ship of foreign build. Both cruisers, it will be remembered, were purchased from the Brazilian government, March 16, 1898, just at the opening of the Spanish-American war. The representatives of the United States did not wish to purchase the Albany (then the Almirante Abreuall of the Brazilian navy) for the reason that she was not near completion, but Brazil would not sell unless both vessels were taken, and our government was very desirous of securing the cruiser which is now the New Orleans. The latter vessel went into commission two days after the date of sale, having been launched Dec. 4, 1896, and came at once to this country, where she was in service throughout the war. The Albany, having been launched Jan. 14, will probably be ready in a short time for her trial trip.

The Albany and New Orleans, which are exactly identical in almost every particular, are classed as unarmored steel vessels—protected cruisers sheathed with wood. They are each 358 feet over all, 330 feet on the water line, 43 feet 9 inches beam, 16 feet 10 inches depth and of 3,437 tons displacement. Tonnage is 2,174 gross or 1,224 net, and their 7,500 maximum indicated horse power gives them a speed of 20 knots. The normal coal capacity is 700 tons and the bunker capacity 800 tons. The maximum draught aft at the lowest point of keel, with the ship ready for sea with bunkers full, is 20 feet 2 inches. These vessels have protected steel decks, extending fore and aft from stem to stern, and are fitted with fourteen water tight bulkheads extending up to the berth deck. In addition to these sub-divisions there are double bottoms, minutely subdivided into water tight compartments, and the store rooms and coal bunkers below the protected deck are also water tight. The protective deck is 1¼ inches thick on the flat and at the ends, and 3½ inches thick on the slopes for the length of the machinery and magazines, with 4-inch glacis plates around the funnel hatches.

The propelling machinery for the Albany was built by Messrs. Hawthorne, Leslie & Co., Ltd., at their St. Peter's works, and consists of two sets of triple-expansion engines, driving twin screws, the maximum indicated horse power being 7,500 at 160 revolutions per minute. The diameter of the high pressure cylinder is 31 inches, intermediate 46 inches, and the low pressure 70 inches, the stroke of all being 30 inches. The propellers are of composition, three-bladed, the blades being separate and secured to the hub by bolts. The diameter of propellers is 12 feet, and the pitch 15 feet 9 inches, buriable 1 foot in either direction. The total area of the three blades is 40 square feet. The air pumps are worked off the low pressure cross head, the circulating pump being of the cylindrical type, worked by an independent engine. There are two main condensers, each having a total cooling surface of 4,500 square feet. The air pumps are 22 inches in diameter by 14 inches stroke. The main engines are placed abreast of each other, and are separated by a water tight fore-and-aft bulkhead. In the starboard engine room there is an auxiliary condenser, with a centrifugal circulating pump and vertical air pump, worked by a common engine, for the use of the auxiliary machinery in port. There are four double-ended Scotch boilers, each 12 feet 3 inches in diameter and 18 feet long, with three furnaces at each end; the boilers being placed in two water tight compartments, with fire rooms at each end. The steam pressure is 155 pounds to the square inch. There are eight forced draft blowers for the purpose of supplying air to the furnaces when the fire rooms are closed. The total grate surface is 468 square feet and the total heating surface 13,156 square feet. There is one main feed and one auxiliary feed pump in each boiler compartment. Half of the double bottom under each of the boiler compartments is fitted for use as a reserve feed-water tank. In each engine room there is one auxiliary pump for use on the bilges, fire main, and water surface. In addition to the above, the vessel is lighted by electricity, the plant consisting of three dynamos and engines. There is also a distilling plant, with a capacity of about fifty tons per day. There is a steam capstan and steam steering engine, and there are ventilating blowers and ash hoists.



UNARMORED CRUISER ALBANY BUILDING AT ELSWICK, ENGLAND, FOR THE UNITED STATES NAVY.—FROM A DRAWING BY R. QUILLER LANE.

SHIP YARD CONTRACTS WITHIN THE WEEK.

A number of Pittsburgers, including Capt. S. S. Brown the wealthy coal operator and Messrs. Schultz of the Schultz Bridge & Iron Co., are interested in a company which will undertake the manufacture of steel boats and barges. Several meetings have been held and it is proposed to provide for an authorized capital stock of $1,000,000.

The Gypsum King, the tug building for J. B. King at the yard of the Burlee Dry Dock Co., Port Richmond, S. I., is the largest tug that has been built in or around New York and is the first steel tug ever launched from a Staten Island ship yard. She is 165 feet 8 inches over all, 29 feet 4 inches beam and 19 feet 3 inches depth of hold. Her speed is 16 knots and she will be ready for service in May.

The Bath Iron Works, Bath, Me., has secured a contract for the construction of a $175,000 steel steam yacht for Isaac Stern of New York City. The plans for the vessel were prepared by Supt. Hanscom of the Bath works, and the yacht will be 200 feet over all, 165 feet water line, 26 feet beam and fitted with triple expansion engines and Scotch boilers.

The tug which the Union Dry Dock Co., Buffalo, has under construction for Charles Persons' Sons, for use at the Buffalo and Grand Island ferry, will, it is announced, be completed by September. The tug will be 60 feet long, 15 feet beam, 7 feet moulded depth and will cost $6,500.

Lieut. Commander J. C. Fremont, 39 Whitehall street, New York City, has asked for bids for the construction of a single-screw tug, 102 feet in length, 24 feet beam, 9½ feet draught, and with triple expansion engines of 900 horse-power. The appropriation for the vessel is $45,000.

Gerald Jordons and Robert C. Morris of New Orleans, the latter manager of the southern department of the National Association of Manufacturers, propose to organize a stock company with $1,000,000 capital for the establishment of a ship yard and the construction of a steel dry dock.

Silas Leach, Brewer, Me., is building a steamer 62 feet in length and 14 feet 4 inches beam for excursion business on Sebec lake.

MARITIME INVENTIONS.

SOME WHICH IT IS CLAIMED ARE NEEDED FOR THE COMFORT OF PASSENGERS OR THE CONVENIENCE OF MEN WHO HANDLE MERCHANT AND NAVAL VESSELS.

The discussion of maritime inventions which are said to be needed or possible, or to speak more correctly the discussion of problems for which such inventions might prove a solution, has long been a fruitful one, and may, of course be expected to continue so, in view of the rapid progression that at present characterizes the ship building industry. A writer upon the subject of inventions in general, Mr. Robert Grimshaw, takes up in the current issue of Modern Machinery the topic of needed improvement in vessel construction. His views along this line are, in part, as follows:

"One thing we need is a composition that will render wood fire-proof, without making it attack iron which is in contact therewith, as much of the recently vaunted fire-proof wood did. A fire-proof coating is no good against the penetration of half-burned and still burning powder grains. The exclusive use of iron, as advocated by constructors and combatants, is impracticable, for several reasons. In the first place, it greatly increases the 'sweating.' Covering iron work with a dope of paint skins and cork chips is good enough for the cabins of merchant ships in hot climates, but is for warships of no use; the entire ceiling, sides and floor cannot be so treated. In the second place, quarters so treated in great surfaces would be uncomfortable or even untenable, and the comfort of officers and men is essential to their health and efficiency. In the third place, such a coating would not only be highly inflammable, but would generate noxious gases in burning. Some one must get up a fire-proof (and rot-proof) wood for sheathing iron work, and for making partitions, floors, etc.

"While on the ship building question, the problem of water-tight doors in bulk heads comes up. These should be easily opened and shut, not only from their own place, but from on deck; and from each there should be an indicator which should show, on deck, whether they were open, shut, or half shut. This indicator should be of a character to sound an alarm when either the door opening or closing mechanism or the indicator itself is out of order. The accident to the battleship Iowa, while in the 'hoodoo' dry dock No. 3, by which a whole compartment was filled with water to the depth of 12 feet, because a sea cock was left open, although its so-called 'indicator' announced that it was closed, points to the necessity (1) of controlling indicators themselves, and (2) of having the condition of all sea cocks not only observable from the bridge or other conspicuous place above the water line, but controllable therefrom.

"There is room for a very considerable improvement in boat-lowering devices for ocean steamers. They must be of a kind that will be absolutely uninjurable by a storm (davits are often bent and rendered unserviceable) and must permit the boat to be lowered when full of passengers and provisions, and cast loose in the twinkling of an eye, and their lowering and casting loose must be effectable (if there is such a word) either from the deck of the vessel or from the boat itself, at will. As a matter of course, both ends of the boat must be cast loose at once. Davits work too slowly and uncertainly, and not easily enough.

"The practical reversing propeller—that is, one with blades the pitch of which may be varied from a maximum in one direction, to zero, and further to the same maximum in the opposite direction, so as to permit reversing the ship's motion without reversing the engine—is not yet. There are many reasons why its invention should be a profitable piece of work. The change of pitch, however, should be accomplished from the engine room or other control point; and preferably without stopping the engine.

"There is yet considerable margin for improvement in ash-hoists on steamers. I know of one vessel (incidentally one in the design of which I had a prominent part) in which the ash-hoist pump makes much more noise than the main engines, and these last are twin triples. For passenger steamers this is offensive, especially at night, and yet there is never any room for much accumulation of ashes in the stoke-room; and if there was, the presence of the hot masses is not conducive to comfort of the stokers, and these need every bit of amelioration of their condition that human ingenuity, backed up by human kindness, can devise.

"A good blower is needed that will not consume too much steam. This appears, on its surface, a small item, and so it might be, if coal consumption were the only thing to be regarded, and if every steamer made only short trips in salt water, or plied exclusively in fresh. But there are vessels in which the water consumption, up the chimney, due to a liberal use of the steam blower, is a much more important factor than the extra coal consumption, and the blower actually costs more than it comes to. The duty of the marine condenser is not half and perhaps not one-fourth what it should be. That is, the average condenser is much too big, and consumes by far too much cooling water. I know of but two kinds which have any claims to a scientific principle of heat exchange between the exhaust steam and the condensing water, and one of these is constructively bad. There is also an opportunity for some one to get up something better than corset laces for packing the ends of condenser tubes. Brass ferrules, wooden ferrules, paper ferrules, all sorts of contraptions, have been proposed and used, and still the average engineer sticks to and swears by the corset lace, if he has ever tried it.

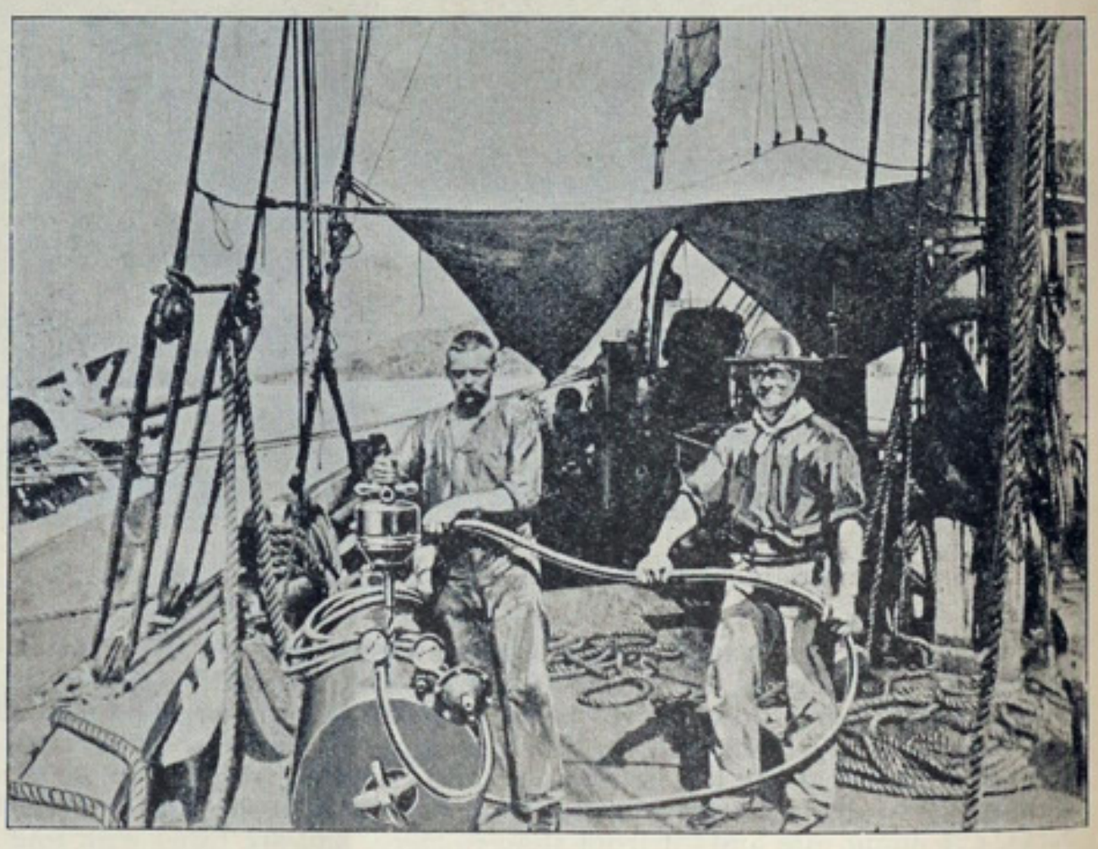
"Anyone who has ever had the deck of a yacht pulled up by steel rigging will agree with me when I suggest that if some benefactor will produce a steel wire rope that has a little give to it, such as one always gets in hemp, many ship owners will rise up and call him blessed. The old-fashioned chains and channels are rapidly disappearing, and eye bolts are taking their places; but it is too much to expect 6 feet in length of hemp at the lower end of 100 feet of steel wire will give as much elasticity as though the entire length had give.

"The thrust-block on board screw ships probably gives more trouble than any other member of the machinery, cranks included. It has a great deal expected of it. It must stand endwise pressure of the shaft, caused by the thrust of the screw, and this sometimes comes in one direction, and (particularly in the case of double and triple screws, where one screw is reversed in turning) sometimes in the other; although not often enough in the backing motion to permit the lubricant to get in. In this respect the crank-pin, which gets its pressure first on one side and then on the other, in each revolution, has the advantage of the thrust block. Then the thrust-block has a very heavy weight resting on it, which pillow-blocks and out board bearings (when these last exist, which is not always the case) do not entirely or even largely relieve, and as the ship rises and falls, the speed changes suddenly from the normal to two or three times that speed, a condition which is much more favorable to cutting than either very fast or very slow all the time would be.

"And this mention of racing brings me to the marine governor. Anyone who has made a trip on an ocean steamer, particularly on one of the greyhounds that cut their way through the water and always have wet decks, knows that the gurring of the screw is about the most disagreeable feature of the voyage. It aggravates seasickness, and never gives a let up, day or night, if the sea be in the least bit rough—that is, if it be anything but mill-pondy, which it very seldom is. The chattering makes every partition vibrate. This makes traveling less pleasant and lessens the number of transoceanic passengers; but it has a still worse effect—it racks the engines themselves, particularly the shaft and the cranks, and it gradually destroys the whole structure (which, after all, is only riveted together) by working the contacting surfaces against each other and making the rivets fit less and less tightly. Thus the evil increases from year to year, and the danger with it. Take a boat of 8,000 tons, and a length of only about nine times the beam, and put 5,000 horse power in it, and this gurring is not so noticeable, and the ship will last comparatively long. But take a hull of 10,000 to 12,000 tons, and a length of twelve times the beam and then put 20,000 to even 25,000 horse-power on board, in order to reduce the trip from twelve or thirteen days with the broad-beamed hull, to seven or even six with the narrow one, and the difference becomes noticeable. We have a hull that is more readily vibrateable by reason of being actually and proportionately longer; we increase the resistance that one meets by increasing (1) the number of vertical and horizontal strains that the waves give it, (2) the amount of endwise resistance that it gets by increasing the speed at which it is driven into the masses of water, and (3) the amount of vertical hammering that it gets by reason of the rise and fall of the great pistons with their attached connecting-rods and cranks—and you can see how the life of a racer, or at least her life as a racer, is much shorter than it would be if it were supplied with a good marine governor."

WRECKING OPERATIONS ON REINA MERCEDES.

If the operations now in progress for the raising of the Spanish cruiser Reina Mercedes at Santiago are not successful it will not be because the most approved methods have not been employed. The expert wreckers engaged on the job have naturally imported from America the automatic tools and improved machinery which have made American wrecking outfits among the best in the world. The accompanying photo, showing the Bover pneumatic hammers and drills in use on the Reina Mercides, was taken by a Russian count who has for some time past been an interested spectator at the wreck. The Russian government, in accordance with its usual policy of keeping in touch with all that is new in maritime practice, has had several representatives at Santiago during the continuance of the operations now under way. One of these officials, Naval Constructor Beliankin, was so impressed with the efficiency of the Boyer tools that he has recommended that every war vessel in the Russian navy be equipped with a full outfit for repairs and other operations.



PNEUMATIC TOOLS ON THE REINA MERCEDES.

The wrecking company used on the work at Santiago Boyer pneumatic hammers and Boyer piston air drills, furnished by the Chicago Pneumatic Tool Co. of Chicago, Ill. The tools were used extensively for work under water as well as for the surface operations. With the Boyer drills more than 300 holes were drilled under water, and the work was done at least thirty times as rapidly as it could have been done by hand. The wrecking company was so well pleased with the results that they are arranging to equip all their new boats with pneumatic drills and hammers.

The American ship Challenger recently loaded a cargo of Pocahontas coal at Norfolk, Va., for Admiral Dewey's fleet at Manila.

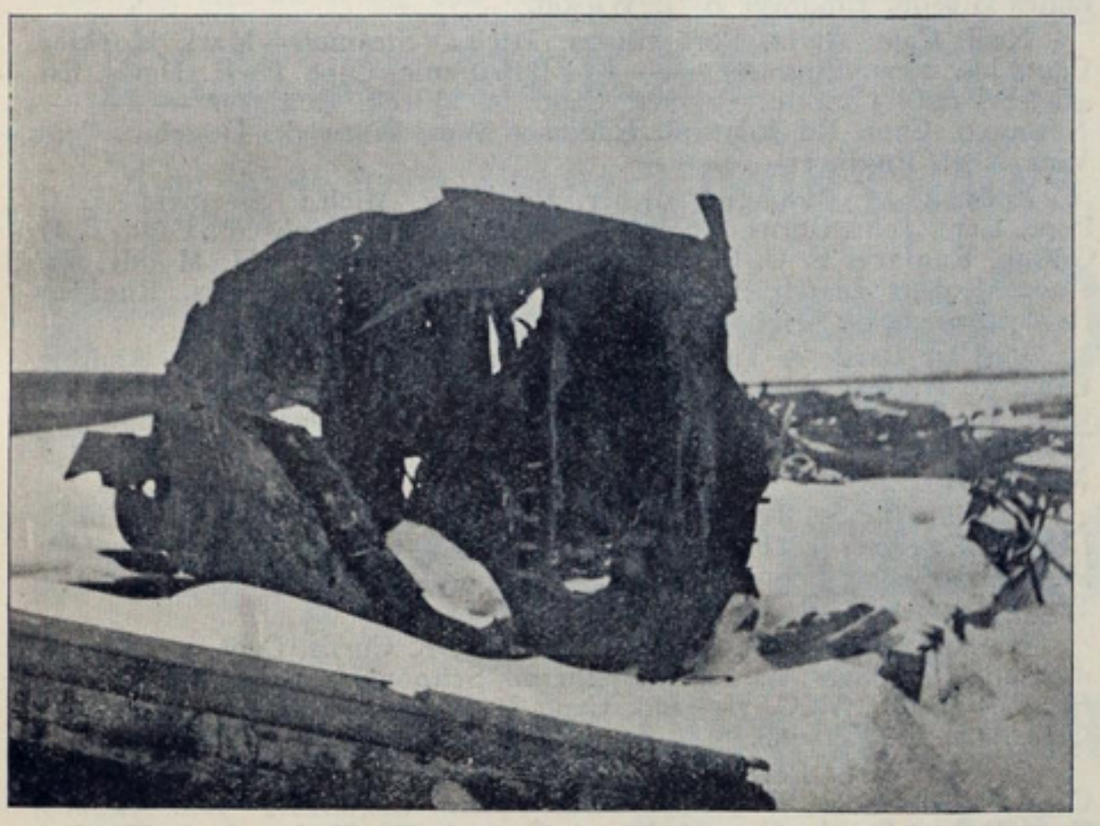
BOILER OF THE STEAMER INDEPENDENCE.

INTERESTING MEMENTO OF ONE OF THE MOST FAMOUS DISASTERS IN THE HISTORY OF NAVIGATION OF THE GREAT LAKES—A SURVIVOR'S STORY.

There is presented herewith a photo of a very interesting relic, fished up in Lake Superior last fall when dredgers were at work widening and deepening the upper channel entrance to the Sault Ste. Marie canal. A mass of iron now lying on a lighter at H. T. Dunbar's ship yard at the head of the canal represents what is left of the boiler of the steamer Independence, which exploded at 11 o'clock on the evening of Nov. 22, 1854, resulting in the sinking of the vessel and loss of seven lives. The Independence was the first steamer on Lake Superior.

Capt. George P. McKay, treasurer of the Lake Carriers' is the only member of the crew and probably the only one of those on board, who survives. He talked to a Marine Review representative the other day regarding the accident. The Independence was a stern-wheel propeller, built of wood and probably not over 150 feet in length, being fitted with a small single engine and boiler of only sufficient power to enable her to attain a speed of 7 or 8 miles an hour. She was built in Chicago and was the first of a number of vessels of this class hauled overland to Lake Superior, there being at that time no canal. The process of moving the vessels around the rapids was very similar to that employed at the present day in moving houses, save that it was considerably more tedious by reason of the fact that instead of using rollers the vessels were slowly dragged along greased ways by means of capstans. A strong cradle was built for each vessel. A number of steamers, including the Peninsula, Manhattan, Monticello, Julia Palmer and Baltimore were thus moved. Oftentimes an entire winter was occupied in the work, and probably the quickest time ever made was in the case of the Manhattan, which was relaunched just one month after she was hauled out of the water.

Capt. McKay's story of the Independence disaster is interesting. "The accident occurred," he said, "during the first trip made by the steamer after she had been purchased by my father, Capt. John McKay.



BOILER OF STEAMER INDEPENDENCE RECOVERED FROM LAKE SUPERIOR.

at that time of Sault Ste. Marie, and Capt. L. McKnight of Detroit. The vessel had been brought up from Lake Michigan several years before, and had a most unfortunate career from the beginning, having stranded a number of times. On two occasions she was on the beach during an entire winter. All the members of our family were rather opposed to father purchasing her. After he did so we spent many months in overhauling her and refitting her for the trade between the Sault and Ontanagon.

"After the repairs were completed up the lake, we made a trip down to the Sault and took aboard a general cargo, consisting largely of material for a new hotel to be erected at Ontanagon. At that time boats lay in deep water off what is now, the head of the canal and were loaded by means of small boats that plied between them and the warehouses on the piers. We were several days in loading and had been under way but a short time when the explosion occurred. I was asleep up forward at the time. I was serving as wheelsman and was to have taken the wheel at 12 o'clock. When awakened by the explosion I hurried on deck and was able to discern the floating debris that covered the water for some distance. The accident occurred just as we were passing over the spot since known as Vidal shoal and which was removed last year. The stern sank almost immediately, but the bows, where hay and lumber were stored, sank slowly, and it was several days before they finally disappeared. Those on board were rescued by Capt. Ripley and a party of Indians.

"The cause of the explosion has remained a mystery, but it is supposed the water in the boiler was allowed to get low and when the vessel got under way the cold water was suddenly turned in. Two engineers, two firemen and three passengers were killed, but the balance of the crew of twenty and the remaining passengers, there being fifteen or twenty in all, escaped entirely uninjured. Numerous wrecking expeditions have visited the scene and the cargo has been recovered piece-meal. It included, however, nothing of any considerable value and no money whatever was lost on the vessel."

The Review is indebted for the photograph to Mr. Leon Bellair, proprietor of the New Bay City House, Sault Ste. Marie, Mich.

STEEL VS. IRON FORGINGS.

In all branches of the arts and sciences progress has always been retarded more or less by traditions and customs that have prevailed, and a reluctance to accept any innovation or departure from established methods then in vogue. At the first glance this would seem to be wrong and to have a tendency to delay benefits that might arise from a judicious use of such approved materials and methods as times would suggest. But, on a second glance it will be apparent that, when due consideration is given to the regularly accepted theories and practices that have prevailed at these various periods, the objections become a retarder or balance to steady and regulate advancement and to guard against any erratic tendencies to indulge in costly experiments that might result in disastrous failures.

In the matter of steel as a substitute for iron, its too rapid adoption has been held in check until such time when the nature and physical properties of the metal had become so well understood that it could be produced for specific purposes with an absolute certainty of result. This has been accomplished by making a study of the metal under the different processes of its production, and its subsequent treatment and the manipulation necessary to produce the finished product for the purpose for which it is intended.

It might be inferred from the foregoing that in order to produce steel as a substitute for iron its production was of a complicated and unreliable nature. To the uninitiated this is true, but to those who are engaged in its production, from the ore in the mines to the boiling metal in the furnaces, and are versed in all the various processes that are necessary to the finished article, it is a comparatively simple process as compared to the production of iron. Especially is this true when it is required to produce the two metals in large quantities and masses.

It is not the intention of this article to give a dissertation on the different processes required to produce iron or steel, but to show that the strong prejudices that have hitherto existed against steel as a structural material, and for the various purposes for which iron has been considered indispensable, are being removed, and have now almost disappeared as the application and use of steel has extended.

At the present time steel is used exclusively for all structural work, ship and boiler plates, angles, beams, channels and I bars, and with the utmost confidence, as experience has shown it to be the most suitable for these purposes, and to the extent that iron is not now considered in any specification of importance. Also, steel is now produced in such quality and quantity, and at such price, that the use of iron is prohibitive, and to the extent that in a short period the manufacture of iron will be one of the lost arts. In the matter of steel forgings for shafts and other parts of marine and stationary engines that are commonly made of iron, the foregoing remarks are equally true. In all the navies of the world, steel of the best quality, specially treated for the purpose, is used for the crank, thrust, intermediate and propeller shafts, connecting rods and piston rods, links, valve stems, reverse shafts, and eccentric rods, and for other parts that were formerly made of iron. The quality and treatment referred to is nickel steel, hollow forged and oil tempered, which represents the highest state of the art at the present time.

Steel forgings of a standard quality are also being used extensively on sea-going vessels in the merchant marine, of which numerous cases could be mentioned; but, as it is to the use of steel forgings on marine engines of the great lakes that these remarks are directed, no individual mention need be made of the use of steel as a substitute for iron in the various parts of the marine engines in sea-going vessels and Atlantic liners.

The use of steel forgings for marine engines on the great lakes has been largely a matter of education, and it may be said of the vessel owner and ship builder of the great lakes, that when he is fully convinced of the superiority of any system or process whereby the problem of transportation is simplified, and the perils of navigation reduced, he does not hesitate to adopt them, no matter what the cost, as the present methods of inland navigation will show.

At the annual meeting of the Lake Carriers' Association, held in Detroit two years ago, a very interesting paper was read on the subject of steel forgings by a representative of the Bethlehem Iron Co., showing the importance of adopting steel of a standard quality for the forgings of marine engines of the great lakes. The paper was illustrated by numerous lantern slides, which showed clearly the various processes of manufacture from the steel billet to the finished product. The paper was listened to with the closest attention by members of the association present, and a lively interest was manifested as the various details were described, which showed clearly the careful work and the high order of the finished forgings. The management of a prominent steamship company present became so greatly impressed at this meeting with the superiority of steel as a substitute for iron forgings, as commonly used for marine engines on the great lakes, that he decided to specify hollow forged, oil tempered steel for the crank, thrust, intermediate and propeller shafts for the quadruple engine to be used in a large vessel for which he was then having plans prepared, with the result that the engine of the fine, large steamer Samuel F. B. Morse was completed last season with shafts of hollow forged oil tempered steel. The tests they have been given have been so satisfactory that shafts of the same material have been duplicated for the engines of three more vessels now being built under the same management. In this connection it may be mentioned, too, that the crank and thrust shafts of the quadruple engine of the Steamer Holden were made of standard open hearth steel, carefully annealed, finished complete, and delivered ready to be put in place, by the Bethlehem Iron Co., as were also the crank shafts for the United States revenue cutters Gresham, Algonquin and Onondaga, built by the Globe Iron Works Co.

Among the new vessels to which the bureau of navigation, treasury department, has recently assigned official numbers are the Standard Oil Co., barge No. 86 of 1,102 gross or 954 net tons, built at West Superior, Wis.; schooner Thaxter of 843 gross or 745 net tons, built at Bath, Me.; steamer Kershaw of 2,599 gross or 1,767 net tons, built at Wilmington, Del.; barge Harry F. of 151 gross or 123 net tons, built at Brooklyn, N. Y.; barge New Amsterdam of 456 gross tons, built at New Amsterdam, Ind.; barge Rosedale No. 6 of 129 gross tons, built at Evansville, Ind.

APPOINTMENTS OF CAPTAINS AND ENGINEERS.

Montreal Transportation Co., Kingston, Ont.: Steamers—Active, Capt. Edward Bennett, Engineer ————; Bronson, Capt. Joseph Murray, Engineer Robt. Hepburn; Glide, Capt. Thos. Murphy, Engineer Jas. Conley; Glengarry, Capt. Gordon Kean, Engineer Geo. Tuttle; Jessie Hall, Capt. Chas. Martin, Engineer Geo. Tuttle; Jas. A. Walker, Capt. John Boyd, Engineer Geo. Boyd; D. C. Thomson, Capt. Jas. Murray, Engineer Geo. Henderson; Bannockburn, Capt. John Irving, Engineer R. Taylor; Rosemount, Capt. J. W. Mawdesley, Engineer John Evans. Lake Barges—Kildonan, Capt. Maxime Lefebvre; Minnedosa, Capt. R. C. Irwin; Selkirk, Capt. Harvey Colville; Winnipeg, Capt. Jas. Kirkwood; Melrose, Capt. Jas. Fleming; Dunmore, Capt. John Phillips. River Barges—Alberta, Capt. Philrome Bradley; Aendia, Capt. Louis Benoit; Bella, Capt. Peter Lalonde; Cleveland, Capt. Alfred Delisle, Sr.; Chicago, Capt. Arsene Charlebois; Colborne, Capt. Frank Poirier; Corncrib, Capt. A. Charlebois, Jr.; Cornwall, Capt. H. Boyer; Detroit, Capt. Treffle Davust; Dorchester, Capt. Joseph Page; Eagle, Capt. A. Monnette, Jr.; Hector, Capt. Theo. Leduc; Glengarry, Capt. Albert Major; Harvest, Capt. Moise Leduc; Iowa, Capt. Joseph Davust; Jennie, Capt. Moise Moreau; John Gaskin, Capt. Israel Davust, Lancaster, Capt. Edward Charon; McCarthy, Capt. E. R. Roy; Montreal, Capt. Mitchel Lefebvre; Maggie, Capt. A. Monnette, Sr..; Nebraska, Capt. Celestia Leboeuf; Regina, Capt. Ovide Trudell; Senator, Capt. Alfred Lalonde; Star, Capt. Ernest Secott; Toledo, Capt. Frederick Leduc; Toronto, Capt. Demars Latour; Wheatbin, Capt. A. Samersall; Cobourg, Capt. Frank Lafrance; Brighton, Capt. Nelson Mallette; Kingston, Capt. Alex. Herbert.

Richelieu & Ontario Nav. Co., Toronto, Ont.: Steamers—Quebec, Capt. L. O. Boucher, Engineer, F. Gendron; Montreal, Capt. L. St. Louis, Engineer, F. X. Hamelin; Canada, Capt. T. Dugal, Engineer E. Dennis; Carolina, Capt. G. Riverin, Engineer M. Latulippe; Three Rivers, Capt. F. St. Louis, Engineer T. Matte; Berthier, Capt. C. Gouin, Engineer E. Areaud; Terrebonne, Capt. E. Gouin, Engineer G. Gendron; Chambly, Capt. G. Paulet, Engineer C. Gendron; Laprairie, Capt. C. McLean, Engineer N. Beaudoin; Longueuil, Capt. F. Jodoin, Engineer N. Beaudet; Cultivateur, Capt. O. Raymond, Engineer H. Noel; Hochelaga, Capt. H. Mandeville, Engineer F. Chapdelaine; Hosanna, Capt. D. Mongeau, Engineer E. Gendron; Fire Fly, Capt. E. Crepeau, Engineer P. Boueker; River du Loup, Capt. F. Faubert, Engineer L. Godin; Toronto, Capt. H. Esford, Engineer W. Black; Spartan, Capt. H. P. Grange, Engineer E. J. Taylor; Algerian, Capt. D. Mills, Engineer T. Wadsworth; Bohemian, Capt. A. Dunlop, Engineer A. R. Milne; Hamilton, Capt. A. J. Baker, Engineer R. Marshall; Corsican, Capt. J. McGraw, Engineer Wm. Parker; Columbian, Capt. C. Hinckley, Engineer J. E. Kane; Caspian, Capt. ————, Engineer A. Menist; Sorel, Capt. A. Berthiaume, Engineer E. Beaucage.

Bessemer Steamship Co., Cleveland: Steamers—Henry Cort, Capt. S. C. Allen, Engineer W. A. Gervin; James B. Neilson, Capt. Harry Gunderson, Engineer A. P. Williams; Sir Henry Bessemer, Capt. C. E. Moody, Engineer Richard Masten; Sir Wm. Siemens, Capt. R. E. Byrns, Engineer J. W. McLachern; Robert Fulton, Capt. H. W. Stone, Engineer J. B. Heyward; Sir Wm. Fairbairn, Capt. W. H. Campau, Engineer S. W. Armstrong; James Watt, Capt. F. W. Stenton, Engineer V. W. Fox; John Ericsson, Capt. John Ward, Engineer D. McVicar; George Stephenson, Capt. John Lowe, Engineer F. H. Warner; Samuel F. B. Morse, Capt. E. M. Smith, Engineer H. J. Reynolds. Schooners—Sir Joseph Whitworth, Capt. Arnold Nordahl; John Scott Russell, Capt. O. W. Holdridge; Alexander Holley, Capt. G. L. Durand; George H. Corliss, Capt. W. S. Hoag; Alfred Krupp, Capt. Samuel E. Lewis; Sidney G. Thomas, Capt. Max Langell; W. LeBaron Jenney, Capt. F. E. Ingraham; Sir Isaac Lothian Bell, Capt. H. A. Burns; James Nasmyth, Capt. J. S. Van Rensselaer; John Fritz, Capt. A. McArthur; John S. Roebling, Capt. Frank Rice.

Anchor Line, E. T. Evans, Mgr., Buffalo, N. Y.: Steamers—India, Capt. P. O'Neil, Engineer D. Donohue; China, Capt. Chas. Christy, Engineer John Wise; Japan, Capt. John Doherty, Engineer Wm. Wilson; Alaska, Capt. Edward Martin, Engineer Edward H. Davis; Wissahickon, Capt. John McCarthy, Engineer Fred Rebhaum, Sr.; Delaware Capt. J. H. McAvoy, Engineer Albert H. Edgar; Junitia, Capt. Geo. Delaney, Engineer John Forrester; Conestoga, Capt. H. Cronkhite, Engineer Wm. Nolan; Lycoming, Capt. L. Wright, Engineer Alex Jones; Conemaugh, Capt. F. Bloom, Engineer W. A. Black; Lehigh, Capt. J. H. Berow, Engineer Timothy Griffin; Clarion, Capt. Chas. Nelson, Engineer James Erskine; Susquehanna, Capt. Dall Ryder, Engineer Geo. McLeod; Codorus, Capt. A. McKenzie, Engineer Wm. Swain; Mahoning, Capt. Joseph Corcoran, Engineer Chas. J. Fox; Schuylkill, Capt. H. O. Miller, Engineer John Jordan.

Groh, Oley, Sheboygan, Wis.: Steamers—Wm. Rudolph, Capt. Rudolph Rieboldt, Engineer Louis Krueger; Susie Chipman, Capt. Nic Gunderson, Engineer Bob Edwards. Tugs—Sheboygan, Capt. Wm. Groh, Engineer Wm. Theak; Satisfaction, Capt. Oley Groh, Engineer ————. Schooners—Quickstep, Capt. Wm. Lorenz; L. E. Raesser, Capt. Theo. Lorenz; City of Grand Haven, Capt. A. Kjelson; J. H. Stevens, Capt. John Olsen; Rosa Belle, Capt. Peter Peterson; H. D. Moore, Capt. Gust Johnson; Lily E, Capt. Louis Gunderson; Levi Grant, Capt. Johnny Freimuth; R. H. Becker, Capt. Chas. Grasshorn; Elizaday, Capt. George Johnson; Jennie Weaver, Capt. E. Larson; Petrel, Capt. Martin Nelson; Jos. Duvall, Capt. Max Pfeil; R. P. Mason, Capt. A. Williamson; Vega, Capt. L. Olsen, Abbie, Capt. H. Halverson; Sardinia, Capt. McDonald.

Mitchell & Co., Cleveland: Steamers—H. S. Holden, Capt. C. B. Galton, Engineer Wm. Fetting; Lagonda, Capt. R. C. Jackson, Engineer Irwin Francombe; J. J. McWilliams, Capt. S. Stratton, Engineer F. B. Parker; M. A. Hanna, Capt. M. P. Parsons, Engineer Henry Graves; W. H. Gratwick, No. 2, Capt. B. D. Townsend, Engineer Peter Lavely; John Mitchell, Capt. Alex. Begg, Engineer J. D. Riley; R. L. Fryer, Capt. F. D. Galton, Engineer Gus Gey; W. F. Sauber, Capt. H. A. Stewart, Engineer Wm. Fritz; Geo. T. Hope, Capt. H. H. Townsend, Engineer L. Minnie; Ed. Smith, No. 1, Capt. C. D. Miller, Engineer C. E. Coon. Schooners—J. C. Fitzpatrick, Capt. T. T. Tallaksen; Angus Smith, Capt. J. T. Lennon.

Detroit, Belle Isle & Windsor Ferry Co., Detroit: Steamers—Victoria, Capt. Jno. Foster, Engineer Walter Merrill; Fortune, Capt. A. P. Clinton, Engineer Fred Wolfgang; Excelsior, Capt. Fred Jarvis, Engineer S. J. Merrill; Garland, Capt. Michael McCune, Engineer George Milne; Sappho, Capt. George Howe, Engineer G. Cunningham; Promise, Capt. Robert Ferguson, Engineer Henry Free; Pleasure, Capt. John Wilkinson, Engineer Nicholas Huff.

Detroit & Cleveland Nav. Co., Detroit: Steamers—City of Detroit, Capt. A. J. McKay, Engineer Wm. S. Huff; City of Cleveland, Capt. A. McLachlan, Engineer James Middleton; City of Alpena, Capt. M. Lightbody, Engineer A. Phillips; City of Mackinac, Capt. H. J. Slyfield, Engineer Wm. McDonald; City of the Straits, Capt. Duncan McLachlan, Engineer James Sargent.

Canada Atlantic Transit Co., Geo. J. Harris, General Western Agent, Chicago: Steamers—Briton, Capt. Jas. B. Watts, Engineer Wm. R. Donaldson; German, Capt. D. Carrier, Engineer J. H. Gilbo; Grecian, Capt. Wm. Baxter, Engineer Thos. Kelly; Saxon, Capt. Alex. Birnie, Engineer Geo. E. Averill; Roman, Capt. A. J. Greenley, Engineer S. A. Wells.

Lake Michigan Car Ferry Transportation Co., J. J. Coleman, Mgr.: Chicago: Steamers—S. M. Fischer, Capt. Fred Johnson, Engineer Jay Phillips; E. G. Crosby, Capt. Alex Bohlin, Engineer George Quackenbush. Barges—No. 1, Capt. Wm. Chambers; No. 2, Capt. Martin Nygard; No. 3, Capt. John Mathisen; No. 4, Capt. Matthew Emmerson.

Corrigan, James, Cleveland: Steamers—Bulgaria, Capt. John McArthur, Engineer John Blauvelt; Caledonia, Capt. Robert Donaldson, Engineer James Cummings; Italia, Capt. J. W. Brion, Engineer ————. Schooners—Amazon, Capt. F. B. Cody; Australia, Capt. Harvey Peters; Polynesia, Capt. F. D. Perew; Tasmania, Capt. J. F. Higgie.

Drake, M. M., Buffalo: Steamers—Lackawanna, Capt. Frank Weinheimer, Engineer W. B. Lewis; Scranton, Capt. James H. Greene, Engineer Chas. Van Every; Russia, Capt. John D. Greene, Engineer Wm. Brown; Cuba, Capt. Robert Young, Engineer H. C. Farrell; Chili, Capt. James Gibson, Engineer A. J. Wilson.

Neal, Capt. Alvin, Port Huron, Mich.: Steamers—Mark Hopkins, Capt. Jas. Neal, Engineer ————; Brittanic, Capt. E. H. Davis, Engineer Frank Cadotte; Pawnee, Capt. Jas. Fleck, Engineer ————; Newaygo, Capt. Ed Johnson, Engineer Wm. Warwick; Gogebic Capt. Wm. Neal, Engineer ————.

Eddy, C. A. Managing owner, Bay City, Mich.: Steamers—E. C. Pope, Capt. John Burns, Engineer John Conroy; Penobscot, Capt. T. D. Gibson, Engineer S. G. Cowell; Selwyn Eddy, Capt. W. H. Moody, Engineer Robert Leitch; City of Bangor, Capt. Wm. Cavers, Engineer Henry Annett.

Playfair Barge & Tug Line, Midland, Ont.: Steamer—St. Andrew, Capt. W. H. Featherstonaugh, Engineer Jno. McRae. Tugs—Magnolia, Capt. R. H. Gilbertson, Engineer A. E. House; Metamora, Capt. Jas. Tindall, Engineer Geo. Smith; Minitaga, Capt. Ed. Burke, Engineer J. McGregor.

Sullivan, L. S., Toledo, O.: Steamer—D. W. Rust, Capt. Wm. J. Leaver, Engineer L. F. DeMay. Schooners—C. C. Barnes, Capt. Geo. W. Burtis; John Schuette, Capt. E. N. VanDusen; Chicago Board of Trade, Capt. Geo. R. Bennet.

Holland, Nelson, Buffalo: Steamer—C. F. Curtis, Capt. James Cunningham, Engineer Wm. Cunningham. Schooners—Isabel Reed, Capt. Peter Johnson; N. C. Holland, Capt. Peter Keischgens; T. S. Fassett, Capt. Wm. P. Johnson.

Currie, Thos., Port Huron, Mich.: Steamer—City of New York, Capt. Thos. Currie, Engineer James Dillen. Schooners—Wm. Grandy, Capt. Robert Smith; Geo. H. Wand, Capt. A. W. Shafer; A. C. Keating, Capt. H. Elby.

Sharp, Wm. H., Bay City, Mich.: Steamer—J. P. Donaldson, Capt. J. A. Ward, Engineer A. J. Wilcox. Schooners—A. W. Wright, Capt. Thos. Thorkildsen; Monticello, Capt. ————; Montmorency, Capt. ————.

Curtis & Brainard, Toledo: Steamers—Cherokee, Capt. W. A. Ashley, Engineer Edgar Arnold; Mohegan, Capt. Wm. Hagan, Engineer Jas. Reagan. Schooners—Chippewa, Capt. Jas. Davidson; Mingoe, Capt. Snelgrove.

West Division Steamship Co., W. H. Wolf, Managing Owner, Milwaukee, Wis.: Steamers—Fred Pabst, Capt. S. C. Sullivan, Engineer W. M. Cavanaugh; W. H. Wolf, Capt. W. Lund, Engineer Thos. Albrighton.

Northern Michigan Transportation Co., E. W. Seymour, Mgr., Chicago: Steamers—Petoskey, Capt. Wm. Finucan, Engineer H. Bruton; City of Charlevoix, Capt. Peter McGuiggan, Engineer Jas. W. Myers.

Hurley, T., Detroit, Mich.: Steamer—Majestic, Capt. M. G. McIntosh, Engineer Fred'k Sherwood. Schooners—Reuben Dowd, Capt. ————; Mystic Star, Capt. ————; Monguagon, Capt. ————.

Mills, J. E., Port Huron, Mich.: Steamers—Argonaut, Capt. J. H. Warwick, Engineer ————; H. J. Kendall, Capt. H. J. Kendall, Engineer ————; Thos. R. Scott, Capt. Paul Rivard, Engineer ————.

Young Trans. Co., W. D. Young, Mgr., Bay City, Mich.: Steamer—Arizona, Capt. J. G. Sauer, Engineer Anthony Ward. Schooners—Scotia, Capt. Walter Hazen; Plymouth, Capt. H. H. Bennett.

Mona Transportation Co., W. W. Brown, Mgr., Cleveland: Steamer—Geo. Presley, Capt. C. D. Woodward, Engineer O. Schneider. Schooner—N. Reddington, Capt. Wm. Packer.

Jenks Ship Building Co., Port Huron, Mich.: Steamers—Linden, Capt. W. H. Larrabee, Engineer L. Carpenter; Black Rock, Capt. Geo. McLeod, Engineer M. Jameson.

Corrigan, John, Cleveland: Steamer—Aurania, Capt. A. H. Gain, Engineer J. P. Klasen.

TRADE NOTES.

The office of the Standard Automatic Releasing Hook Co., NewYork, is now at 1001 New Cheesebrough building, No. 17 State street.

A new fuel dock 600 feet in length is being built by G. Herman & Son, fuel dealers of Toledo. The dock will be completed about April 15.

Additional ground has been purchased by Wickes Bros., Saginaw, Mich., boiler manufacturers, on which they will build an extensive addition to their plant.

An additional erecting floor and machine shop is being built by Pawling & Harneschfeger, Milwaukee. The building is of brick, 50x125 feet, three stories and basement, and will be used to provide space for the manufacture of traveling cranes.

A four-story addition is being built to the works of the Joseph Dixon Crucible Co., Jersey City, N. J. The building will be used for the manufacture of pencils. The company expect to build a very large addition to their crucible plant during the summer.

Col. Oliver Payne's elegant new steam yacht Aphrodite, which is among the finest pleasure craft of the world, will be ready to leave New York, where she is now being fitted out, about June 1. Life boats of this vessel are equipped with Standard automatic releasing hooks.

George E. Hardy and Fred. A. Dischinger, who are well known in vessel circles at Toledo, (especially Mr. Hardy), have lately begun business on their own account, under the firm name of Hardy & Dischinger in the Neptune building at the foot of Jefferson street, Toledo. They will handle a general line of steamboat, railroad and mill supplies, lubricating oils, packing, paints, etc.

Edward Robinson of New York, sole proprietor of the well known Wells light in this country, sails for England Saturday, to be gone about six weeks. The extent to which Wells lights are now used is wonderful. There are over 12,000 of these kerosene lights in use, ranging in candle power from 800 to 4,000. They are especially adapted for docks, ship repair plants, dredges, mines etc. Over 400 railroads and some 500 contractors use them.

An announcement from the L. Black Co. of Detroit is to the effect that they have just received a large stock of marine glasses, barometers, telescopes, etc., all of the best makes, the shipment including the well known Par Excellence and Maxium glasses, which vessel men regard among the strongest and best made. They also have this year a new kind of glass, the first made in this country, and their line of barometers is complete and first-class in all respects. The L. Black Co. makes a specialty of repairing marine glasses, barometers, compasses and telescopes.

Merchant & Co., incorporated, of Philadelphia, New York and Chicago, recently received an order from the war department for 786 of their galvanized star ventilators, for use in officers' quarters and barracks, to be erected at Havana and Matanzas, Cuba. There will be 587 ventilators of 24 inches diameter, and 199 of 14 inches diameter. Great promptness is necessary in delivery, which the exceptional facilities of Merchant & Co. will enable them to accomplish. Some idea of the size of this order may be gained from the statement that if these ventilators were placed in a line with their edges touching, they would cover a distance of nearly half a mile. Within the last few months Merchant & Co. have supplied 500 18-inch ventilators for new government hospitals at Fortress Monroe and Savannah.

Arrangements were made several weeks ago whereby the Youghiogheny & Lehigh Coal Co. of Chicago, came into possession of the fuel dock and steamboat business of the O. S. Richardson Fueling Co. in that city, but formal announcement of the transfer is just at hand. The Youghiogheny & Lehigh company, operating in Chicago and West Superior, is a part of the combination of coal producing and shipping interests that includes also the Pittsburg, Fairport & Northwestern Dock Co., managed by Geo. E. Tener of Pittsburg, and the Pittsburg & Chicago Gas Coal Co., managed by John A. Donaldson of Cleveland. These two latter concerns operate extensive docks, car dumping machines, etc., at Fairport and Cleveland, so that the interest now controlling the Richardson dock in Chicago has some very strong connections. It is the intention in Chicago to keep, in addition to the service of two lighters of 250 tons capacity each, a stock of several thousand tons of Youghiogheny coal on docks in the north branch of the Chicago river, near North Halsted street bridge. Connected with the Chicago business are John T. Connery, manager, Archie J. Hitchcock, dock superintendent, Capt. Charles Wallace, salesman, and Geo. Lynn, chief engineer.

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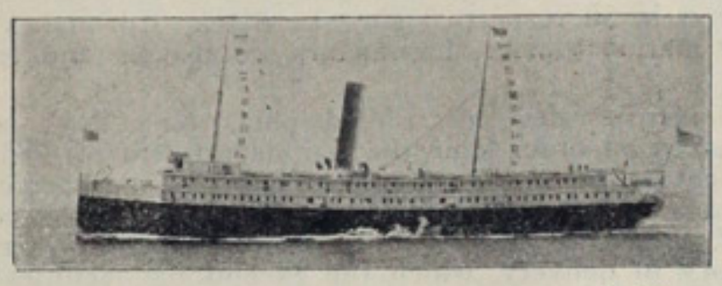

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